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FACULTADES DE CIENCIAS QUÍMICAS, INGENIERÍA Y MEDICINA

PROGRAMAS MULTIDISCIPLINARIOS DE POSGRADO EN CIENCIAS AMBIENTALES

AND

TH KÖLN - UNIVERSITY OF APPLIED SCIENCES

INSTITUTE FOR TECHNOLOGY AND RESOURCES MANAGEMENT IN THE TROPICS AND
SUBTROPICS

The role of connectivity for sustainable regional development in the Highland Plateau Zone of San Luis Potosí

THESIS TO OBTAIN THE DEGREE OF

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For my parents and my brother, for their love and strength.
For Javier Trujillo, for reminding me every day that I am not alone.
For my family, for having faith in me.

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ABSTRACT

The Highland Plateau region, in San Luis Potosí, involves particular dynamics and needs from those presented within the rest of the state; its culture, vocation, mineral resources and territory, converge to give rise to a unique and particular region. The connectivity within the region has been decisive for its development, since two of the largest and most important national roads in go through this territory.

Despite comprehending about a half of the state's territory, this region has not managed to truly influence the state statistics neither economically nor socially; on the contrary, the employment rate has significantly decreased significantly, and also its population number.

Accordingly, this research aims to analyze the connectivity system within this region to strengthen and complement the development tools of these communities in a sustainable manner and, in this way, increase the welfare of the Highland Plateau population.

Throughout this investigation, it will be possible to understand how the location of this physical network, as well as for the use of resources for the satisfaction of the inhabitants, has been reflected in the communities within this region. Likewise, the statements made by state directors in charge of the economy, road network and social development within the region, will be studied. These statements will also be combined with a “functional grid analysis”, the connectivity between communities and their basic needs.

Keywords: Connectivity, regional development, sustainability, mobility, accessibility.

RESUMEN

La región Altiplano, en San Luis Potosí, presenta actividades y necesidades distintas a las de otras regiones dentro de este estado, debido a su cultura, su vocación, sus recursos y territorio. Es por esto, que es necesario desarrollar herramientas para su desarrollo regional, las cuales comprendan estas particularidades. Así mismo, la conectividad dentro de la región ha demostrado ser determinante para su desarrollo, pues corren a través de su territorio, dos de las más grandes carreteras federales.

A pesar de comprender cerca de la mitad del territorio estatal, esta región no ha logrado influir positivamente en las estadísticas sociales y económicas del estado; por el contrario, la tasa de empleo ha disminuido significativamente dentro del Altiplano, así como su número de habitantes.

Por tal motivo, la presente investigación pretende analizar la conectividad dentro de la región para fortalecer y complementar las herramientas para el desarrollo de estas comunidades de una manera sustentable y, de esta manera, incrementar el bienestar de la población dentro del Altiplano potosino.

A lo largo de esta investigación, será posible encontrar afirmaciones de dirigentes estatales encargados de administrar la economía, la red carretera y el desarrollo social de los habitantes de la región, así como un “análisis funcional de la red” para la estructura física que conecta a cada comunidad con los servicios básicos de educación, salud y alimentación.

Palabras clave: Conectividad, Desarrollo regional, sustentabilidad, movilidad, accesibilidad.

1 INTRODUCTION: THE REMOTE ALTIPLANO AND ITS CONNECTIVITY

1.1 Problem definition

The balance between urban and rural entities in central Mexico, has been drastically modified. Currently, the whole world is facing a population concentration within the increasingly larger cities; according to the World Bank of data, in fifty years (1966 - 2016) the percentage of urban population went from 35 to almost 55% (The World Bank Group, 2018).

Sometimes, the interaction between communities inside a big system can generate a complexity beyond what the communities themselves present (Watts, 2006). This progressive migration of inhabitants to the urban environment and, consequently, the imbalance within the regions, has shown a growing complexity.

How the large infrastructure networks are vulnerable to random failures in small points? In what way are individual behaviors associated to collective behavior? Although it is simple to formulate, this is one of the most fundamental and omnipresent questions of science in general (Watts, 2006).

What makes the system difficult to address is that, while the whole is made of its parts, it is, instead, more than just its sum. More exactly, the pieces interact with each other, and when they interact, even when it is all about relatively simple components, they can have a disconcerting behavior.

The regional imbalance present in almost every Mexican territory, is a chain of unbounded problems that require a multidisciplinary and regional approach to be addressed.

There is a conceptual and methodological gap in the analysis of the way mobility is handled in Mexico, and also in the relationship between mobility, regional transportation systems and territorial planning (Martner, Balbuena, Bustos, & De La Torre, 2008).

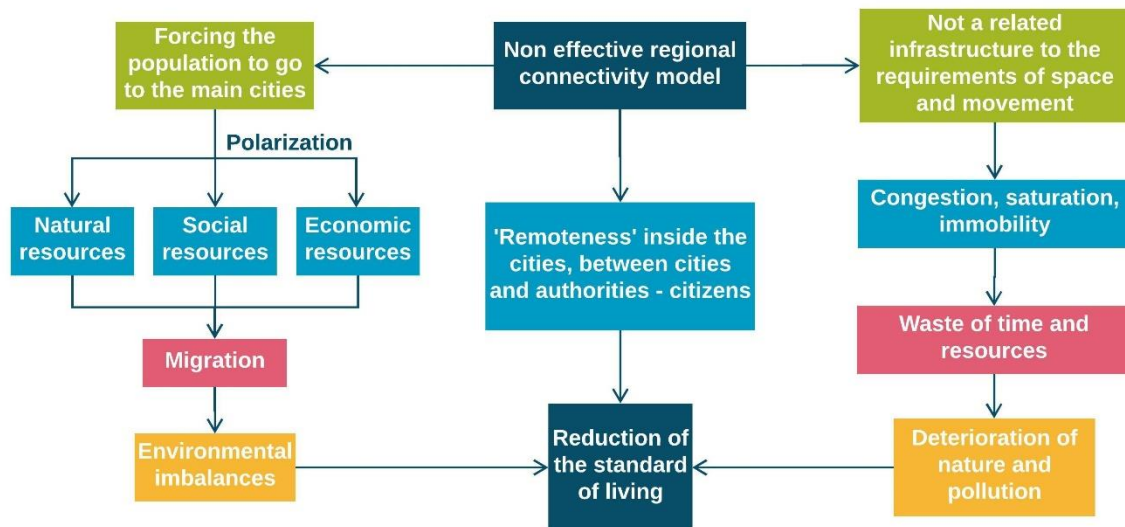


Figure 1.1 Issues addressed by a regional approach (Gallegos, 2017)

This problem leads us to implement an investigation to understand what has led the Highland Plateau region (Altiplano) in the state of San Luis Potosí, Mexico, to develop the currently imbalance among its entities, as well as its administration strategies in order to identify the necessary actions to cover some of its most basic and demandant needs and in this way, raise the standard of living of the population and make their development conditions also sustainable.

Within this research, the impact of connectivity and its structure, will be proven to be a fundamental mean for equal accessibility and regional development within the Altiplano; because, as will be seen later, the demand of natural resources, has been one of the main problems this region's population is forced to face.

1.2 Objectives

General

To develop an analysis of the connectivity within the Highland Plateau region of San Luis Potosí, Mexico for sustainable regional development.

Specific

To analyze the economic, physical and social indicators of the Highland Plateau region through field research, interviews and official data.

To identify the connectivity effectiveness within the region through a functional grid analysis

To develop an analysis for the current state of connectivity within the region and the administrative strategies for sustainable regional development

1.3 Structure and content

After defining the problem and the general approach to the thesis, this document is structured as follows:

The major terminologies and categories of analysis will be derived from literature in chapter two, which concludes with a more detailed, theory-driven conceptual framework. This is the base for the elaboration of the methodology for this investigation, which will be detailed in the third chapter.

The Highland Plateau (Altiplano) of San Luis Potosí will be presented as a case study in chapter 4, its regional history, as well as its public administration and physical and social structure, based on national and state data, to later observe its current status for the development in the economic, structural and social sphere in chapter five.

Later on, in the chapter five, a functional grid analysis of the Altiplano region will be developed, based on indicators for connectivity and sustainable regional development such as economy, social welfare and infrastructure.

Within chapter six, the coordination of the instruments and the secretariats that implement the administration of the Altiplano region will be evaluated, through field visits and interviews, it will be possible to identify the areas in which the state contributed the most.

The seventh chapter will connect the convergence of connectivity for sustainable regional development with the actions and strategies that the state secretariats have accomplished, to conclude with recommendations and further research demands in chapter eight.

2 CONCEPTUAL FRAMEWORK: THE ROLE OF CONNECTIVITY FOR REGIONAL DEVELOPMENT

Connectivity with a regional approach, as will be seen next, has benefits that include sustainable development and the leverage of resources. Therefore, we will consider the conformation of a 'successful' region; for a regional approach, certain conditions must be implicated.

Likewise, connectivity within a region has variables and approaches worth mentioning for its study. The objectives of the strategic connectivity planning, as well as its successful execution, are reflected in welfare for the population, as will be observed in this chapter.

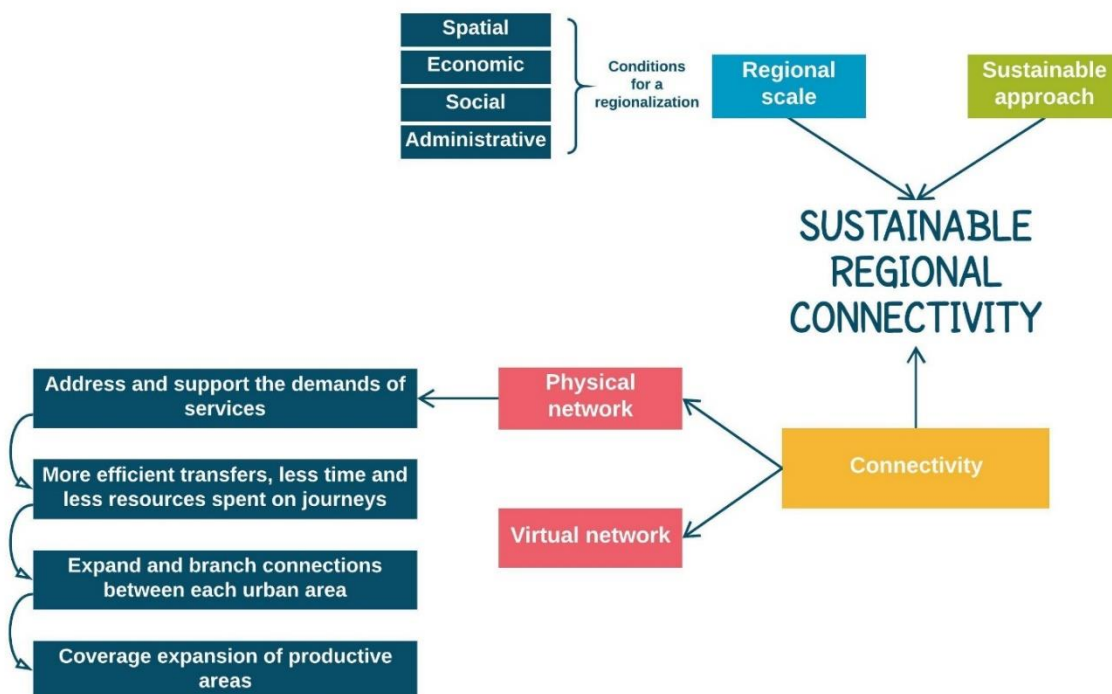


Figure 2.1 Sustainable regional connectivity and its implications (Gallegos, 2018).

2.1 Approaches to sustainable regions

Current approaches and types of regions

Geography is closely linked to the total life of a region and the constant human struggle to make more rational the exploitation of natural resources, more equitable distribution of wealth and to improve the location of productive forces (Salguero, 2006). The distribution of resources and services within the territory directly affects the entire population, which is why a multidisciplinary vision is necessary for its planning.

The dynamism that takes place within each country, cannot always be covered at the state level, because the politically imposed limits do not contain the whole exchanges of resources or services, so a regional analysis is necessary.

With a regional approach the results are translated into more appropriate use of the territory and its natural resources, the increase the productivity rates, reducing imbalances by detonating disadvantaged areas and also improving the quality of life of its inhabitants (SEDESORE, 2014), but what exactly is a region?

The concept of 'region' contains a large number of meanings and its extension is diverse. In what is widely agreed, is that the region as a general rule, means any part of the territory that is smaller than the whole country, which has specificities that make it a unit. (Celis, 1988). As an addition to this definition, each region is made up of units of continuous territory.

Regional knowledge is a combination of methods, methodologies and cartographic techniques that, in addition to complementing the observation of social processes in the territory, takes advantage of the tools generated by other sciences to obtain complete data on the transformations presented by regions, beyond its political-administrative limits (Torres, 2006). Some of the

elements that are included to form functional regions are physical elements, population practices, popular culture, economics, among many others.

As an "ideal" region, we understand the regionalization by which the following aspects have been considered:

- Spatial conditions. The regions must be continuous geographical spaces and must have an adequate internal connection.
- Economic conditions. The economic structure must be diversified and at least it must contain an urban center potentially capable of serving as a center of growth.
- Social conditions. Social conditions are associated with the connection and social understanding of the population and / or their regional commitment.
- Administrative conditions. Regionalization must coincide in some way with the geographical limits of any of the possible divisions, at least in the first instance (Celis, 1988).

From the point of view of a regional analysis, it is possible to identify three types of regions, based on its conformation: the homogeneous, the programmed and the nodal (also called heterogeneous) (Klapka, Halás, & Tonev, 2013).

Homogeneous regions are usually identified based on homogeneity criteria and they are based on state variables (e.g. if population density is between 100–200 ppl per km²). **Nodal or heterogeneous regions** are characterized by a common link of basic spatial units of various sizes, they are linked by certain relationships which are happening at a horizontal level. The third type, **planning regions** are defined for a specific

purpose based on the specific requirements of research (Mendel University in Brno, 2010).

The German school was the first to study the interaction inside a region between rural and urban entities; the internal structure of nodal region did not, according to Klapka and Tonev (2008) emerge at one point but it underwent a gradual development. Christaller¹ identified the core and periphery, Lösch² divided an area into sectors where settlements or activities were focused.

In his work, Von Thünen (1826) constructed a model of strategic planning to explain the urban - rural differences and interactions, based on land prices and transportation costs. His model was based on transport costs between one center and another but also its quality (Moncayo, 2001).

The post-war decentralization policies have resulted in relatively equal standards of living between regions as well as urban and rural areas, by both international and European standards. The German case provides insight into regional development pathways and instruments, balancing economic requirements and social objectives (Dick, Inkoom, Teodoro , & Gaesing, 2016).

The German theories focus on the economic benefits that the strategies can provide (Palacios, 1983). In order to further explain the spatial arrangements and distribution of human settlements and their number based on population and distance from another human settlement, one of the most appreciated theories is the one created by Walter Christaller; which will be deepened later.

¹ Born in southern Germany in 1893, is the creator of a land-use planning system called "Die Zentralen Orte in Süddeutschland" as his PhD thesis, his ideas were implemented in Poland and southern Germany (Hottes, 1997).

² German economist, born in 1906, wrote in 1940 his most famous work: "Die räumliche Ordnung der Wirtschaft" (Zottmann, 1949).

In the Mexican context, new tendencies of urban-regional concentration and dispersion have emerged and, therefore, a high dynamism of medium-sized cities (Martner, Balbuena, Bustos, & De La Torre, 2008).

Development in Mexico, as a complex phenomenon, is not presented in a homogeneous way, on the contrary, it is reflected differentially between spaces, showing imbalances, regional disparities and problems that need to be studied to find suitable solutions (Álvarez, 2009). To understand the regional inequalities, in this country, numerous works have been developed with a regional approach (Velasco, Maldonado, & Torres, 2007). In spite of this, Mexico still suffers from a lack of well-defined and coordinated regional systems. The approaches have been limited to cover the national needs, which have tended to increase concentration of industry and population in some areas (Rodríguez-Oreggia, 2007).

Sustainability about a regional approach

The diagnosis of the economic, social and institutional conditions of every territory and the identification of local economic potential are the foundations upon which such development strategies are built (Pike, Rdz. Pose, & Tomaney, 2006). A sustainable regional approach, lies in ensuring the resources for the population; managing them efficiently and for future projections to guarantee supplies.

In a territory characterized by imbalance, actions focused on regional sustainable development, must be systematized in order to achieve greater geographic reach, with better social reach and faster results, as a consequence, the regional equality spur sustainable growth nationwide, grounded in the potential of the region; this development, accordingly, should be a responsibility of the government, but above all of the inhabitants of each region, who are more familiar with its specific characteristics and problems (De

Carvalho & Fogliatti, 2016). Therefore, the articulation between not only local but also regional needs and the agreement of the authorities, result in sustainable strategies for the fair distribution of goods and in their use, strengthening the region.

2.2 Concepts of connectivity, mobility and their relation

Mobility within the connectivity network

The expression 'connectivity' is increasingly frequent; appropriate for the increasingly field of telecommunications and new information and communication technologies (Santos y Ganges & De las Rivas, 2008). The term is developed from the existence of links between objects and functions that are interrelated, it is important the "good" connectivity for the country, as well as for its regions, and to evaluate it, in this way new standards of improvement can always be imposed (Figueroa & Rozas, 2005).

The term connectivity is still conceived as something imminently linked to the internet or virtual networks³, on the contrary, it is necessary for this work the physical vision of road networks within which the connections of services and resources are possible.

Connectivity due to its ways of manifestation, diversifies into two main types: digital and physical, as shown in the following table:

³ Connectivity: the ability of a computer, program, device, or system to connect to the internet, another computer, etc. (Cambridge dictionary, 2018).

Digital connectivity	Physical connectivity
It is a system of networks connected by communication links in order to share data (Elahi & Elahi, 2006); the character of the information era owes its existence to technologies such as computers, telecommunications networks, electronic media and the Internet. The basis of this communication are electronic devices, which provide the energy to generate, manipulate, manage and contain information (Corey & Wilson, 2006).	Is the structure developed by a network of corridors intertwining different parts of a territory (Figueroa & Rozas, 2005), within this network of corridors, different geographical points are connected and as a result, mobility relationships between people, resources and services can be established (Santos y Ganges & De las Rivas, 2008).

Table 2.1 Kinds of connectivity (Gallegos, 2018)

The planning of regional connectivity for a social, economic and natural balance focuses precisely on this physical network of corridors through which the mobility of resources flows every day. The main components that reflect the effectiveness of this road network are the coverage required to support the daily traffic generated by the needs of the inhabitants, as well as the quality offered by this infrastructure to accomplish safer and more efficient connections.

For the development of a region, it is essential to integrate the territory through the transport network, since isolated entities develop economic and social disadvantages compared to those that have exchanges of services and resources with other entities (Figueroa & Rozas, 2005).

The term connectivity for territorial planning, refers to ideas of union, interrelation and connection. The entities always pursue ideals such as the growth of their economy, the complete coverage of productive areas, the development of infrastructure and the increase of direct connections that each urban area has with the rest, all these aims are based on a “successful connectivity” (Santos y Ganges & De las Rivas, 2008).

For the quantification of connectivity, the satisfaction of the demands of the population is measured in the shortest time and with the highest quality possible (Iracheta, 2001). A successful connectivity also generates development for the structural competitiveness⁴, which is centered on the specialization of the economy, technological innovation, the quality of distribution networks in the region and location factors, all of which constitute the state of supply of goods and services (Hatzichronoglou, 1996).

2.3 Own approach: Regional connectivity and mobility and their contribution to regional development

Connectivity with a regional approach

When the regional structure does not respond properly to the requirements of space and efficient movement of people and goods, it is usual to develop problems of congestion, saturation, immobility, among others (Jiménez-Jiménez, de Hoyos-Martínez, & Álvarez-Vallejo, 2014).

Regional connectivity refers to continuous geographical spaces with an adequate connection between the contained entities; the region needs to

⁴ The result of the successful management of the companies, but also takes into account the strength and efficiency of the national productive structure, the technical infrastructure and other factors that determine the externalities on which the companies rely (OECD, 1992).

contain an urban center capable of serving as a growth center. Likewise, the connection and the social understanding of the population and their regional loyalty are of vital importance for connectivity (Celis, 1988). The connectivity with a regional scale seeks benefits which are deeply related, as mentioned by several authors, with the population welfare its balance with its surroundings.

According to the aforementioned Lösch, the conception of “region” before his proposals, were arbitrarily and accidentally determined, his intention, therefore, was to propose a new concept that would overcome these limitations and conceive a "more natural and lasting spatial order of elements" (Palacios, 1983).

A theory that seeks to categorize and order regional connectivity, is the so-called "Theory of the Central Place", proposed by the already mentioned Walter Christaller and later complemented by Lösch.

According to the Theory of the Central Place; the entities within the country are hierarchized according to their importance; the cities of first order are determined by their prominent economic activities and functions they perform, contributing significantly to the production and employment of the country (Christaller, 1933).

Connectivity in sustainable regional development

Regional connectivity, as the basis of the interactions for the welfare of a society, should also contribute to the innovation of more sustainable and less polluting technologies.

Within the voluntary mobility of the population, two fundamental types have traditionally been distinguished, long term/permanent and temporary, the first being characterized by a modification of the place of residence and the second by referring to short, repetitive or cyclic movements (Zelinsky, 1971).

The study of mobility has been affected by new phenomena, among which it is possible to mention the increasing abundance of second homes, tourism, seasonal agricultural work, return migration (both domestic and international), or the occasional accommodation during the work week and the later return to the family residence during the weekend. These phenomena make mobility something entirely diverse (Casado, 2008).

Mobility is also a process that generates relationships (Korstanje, 2013). According to this author, our future is increasingly unpredictable, since the paradigm of mobility is constantly changing it. Faced with the issue of ecological pollution, the actual society cannot be content with destroying his system of mobility, however, seeks its modification and evolution to achieve this evolution.

Framework: indicator set for sustainable regional development

Debates about this development have shifted from a focus on the quantity of development to a concern with its quality; initially, this involved a focus on the economic sphere, however, the natural environment, its use and preservation has increasingly been more considered as a part of the objectives (Pike, Rdz. Pose, & Tomaney, 2006).

For sustainable regional development, it is necessary to fully understand the dynamics; therefore, within this investigation will be certainly analyzed, the economic sphere, but also will take a look as well in the administrative strategies and the different organizations in charge of this region, because, as will be seen later, this sphere directly influences the development. Likewise, the infrastructure through which the communities can connect with each other and the facilities location and distribution to cover basic needs such as health, education and food supply, will be evaluated.

3 METHODOLOGY

3.1 Type of study

This sustainable regional development research will have qualitative and also quantitative data.

Due to the wide nature of the factors it is intended to work with, it is necessary to collect social quality data of the Altiplano communities, but also the connectivity infrastructure between communities for sustainable development of the region will be reviewed, this data will be reflected in quantitative figures.

3.2 Indicators for regional connectivity

Mobility of goods, resources and people

In general, the regional development is directly linked to the economic needs of the population, however, to complement this development with a sustainability approach, it is necessary to cover in like manner, for the social welfare, the administrative system, its strategies and the infrastructure within the territory; for this reason, the indicators will cover these three main aspects of the region:

- 1. Economy and employment rates**
- 2. Public administration**
- 3. Services distribution and physical network**

Each area, as will be seen below, implies specific indicators that can allow us to understand the current situation and the development the Highland Plateau region has presented up to the present time.

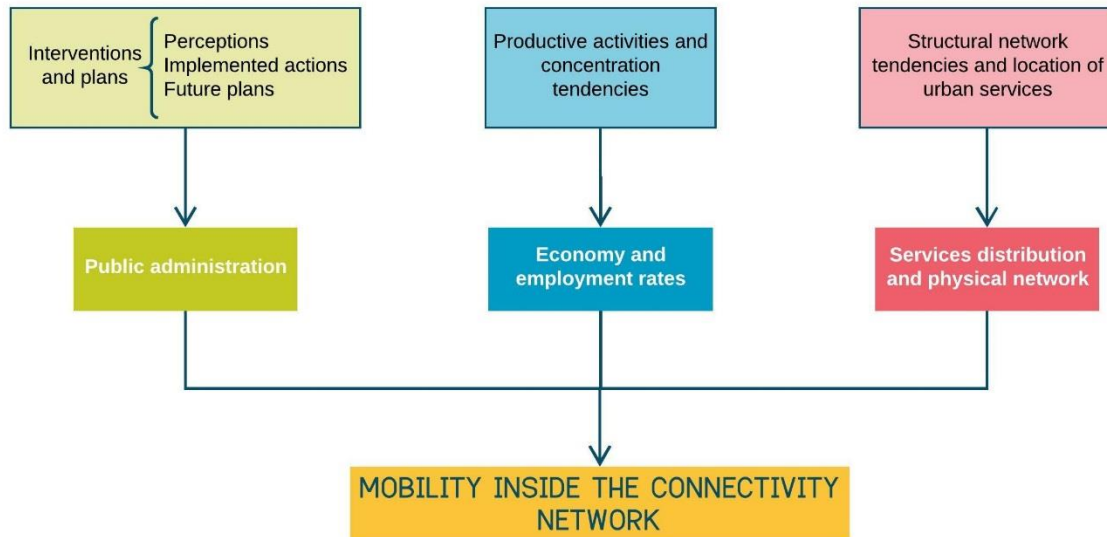


Figure 3.1 Main indicators for connectivity for sustainable regional development (Gallegos, 2018).

1. Economy and employment rates

The context for regional development, has been dramatically reshaped by deep changes in the pattern of economic activity and has become significantly more challenging (Pike, Rodríguez-Pose, & Tomaney, 2006). The economic system has been globalized; and along with it, the constant economic flows forcing to deal with different market systems. In this perspective, it is reasonable to increase the already existent imbalance between entities prepared to support this flow, and those the lack of inclusion to the international system is leaving behind.

One of the main traditional aspects determining the regional development, is of course the economic homogeneity (or in some cases disparity) and growth of the region. The geographer August Lösch, in his work "The Economics of Location" marks that a region corresponds to the idea of defining the territory

from the way productive activities are distributed over the territory, and economic processes take place, considering the friction of distance.

In response to the theory Walter Christaller developed and its complementation by August Lösch, it can be deduced that the economy in a certain region is directly affected by the connectivity structure contained, as it is indicated throughout their texts: a strategic network minimizes transport costs and covers the supply demand of the population.

Within his theory of the central place (Systems zentraler Orte), Christaller specifies that economic activities conduct and also distribute the population surrounding them. Therefore, the hierarchy of a population center resides in the economic efficiency it reaches, which in also depends on its area of influence (Asuad, 2014). The mobility of economic resources presented inside the Altiplano region will be addressed to identify flows and concentration within the territory, which has a profound impact on communities.

Economic forces expose even the most remote spaces to competition and firms, localities and regions to react and adjust to the new economic conditions (Pike, Rdz. Pose, & Tomaney, 2006). As a result, it is necessary to perceive the regional panorama in the economic sphere, since the settlements are deeply affected by the advantages capital mobility, trade and transfers of technology can provide.

Economic openness and the search for stability at the national level must begin with an internal regional strength; an internal restructuring to face possible competencies with other regions and the advantages they contain, to avoid external pressures (Pike, Rodríguez-Pose, & Tomaney, 2006).

The polarization of economic resources, likewise, results in the development of individual strategies by the communities (Morong R. & Sánchez E., 2006), fragmenting social relations and their commitment to the region in general.

2. Public administration

The public administration of the territory is closely linked with the development (Pike, Rodríguez-Pose, & Tomaney, 2006). The public administration is responsible for developing and executing the plans that are generated within the territory, they are also responsible for defining the space and time in which the proposed objectives will be met, as well as for justifying the management of public resources.

With an increasingly dominant and omnipresent capitalist economy, an increased capacity from the administration to respond and adjust to these challenges necessarily implies to create factors that will allow to place every skills, products or services of each settlement in the regional, federal and global network.

The state is in charge of driven but also safeguarding the interests and needs of the individuals, as well as the natural resources which are also part of the territory. For this reason, the organizations in charge of managing the Altiplano region, the legislative instruments they have, as well as their current operational system they present to implement these instruments, will be considered.

According to the Mexican urban planner Alfonso Iracheta, in the Mexican territory the geographical focus for regional projects has prevailed, so the projects carried out have not adequately covered the regional needs. Likewise, he declares federal agencies operate without truly knowing the regional impact that is being produced because of these decisions (Iracheta, 2001).

In order to face the industrial network of global scale to which the state of San Luis Potosí is currently being inserted, a regional policy is required to articulate all the public organisms and to promote a more balanced growth.

The coordination of the municipalities through regional instruments generates a perspective of openness among them and of "closeness" with the other communities of the region, because as Lösch indicates, a political frontier is also an economic boundary; by nature, it is hard to cross (Lösch, 1978).

Added to this regional perspective, is also found the importance of coordination between projects of different public organizations; each public organization must recognize the projects the other sectors are working with and articulate their own interests with each other; to look for congruence.

3. Services distribution and physical network

The efficiency of connectivity between the nodes inside some territory, resides precisely in the satisfaction of needs presented by the population; translated physically into accessibility and speed indicators (Santos y Ganges & De las Rivas, 2008). The particular character every region presents, are the flows occurring inside the territory.

In addition to the economic field, the development of a region is also perceived with the quality of the network distribution and the location of services; all of this assure the supply of goods and services among the region (Hatzichronoglou, 1996). To analyze the structure by which all these interactions and movements are carried out and recognizing their elements, drift us to know the very essence of the region.

In the classic analysis of transport networks (a transport system based on branches and nodes) the choice of routes is always presented by identifying their area centroids and their connectors (Santos y Ganges & De las Rivas, 2008). One of the general objectives of the regional approach, as mentioned before, is to raise the general welfare level of the population, so accessibility to basic services through strategic infrastructure coverage can be translated into regional development.

Going back to the principles presented by Walter Christaller, the spatial distribution must guarantee supply of basic services for the entire population. The population demands are classified by their relevance and need of proximity for communities; the immediate order services are basic education, food supply and health centers.

In response to these precepts, the coverage of these three main services for the communities will be evaluated through ArcMap; a processing program used to analyze geospatial data. This tool is very useful to model georeferenced transport networks and know the optimal routes for greater accessibility to services. The coverage of services will be presented, first for pedestrians, and later proceed to indicate the accessibility by motorized transportation and the options the region has to offer as it is now.

This connectivity network will be presented divided by municipal, state and federal order, for its better management, as well as its hierarchy and directions.

These procedures will be applied in the Highland Plateau of San Luis Potosí, which fulfill the requirements for the analysis to be viable, as will be seen next.

in the next chapter, we will analyze the particularities that make the Altiplano suitable to these considerations, since it is not yet a consolidated region; its

current stage of development still allows the adjustments and reinforcement to the strategies to guarantee its sustainability.

3.3 The collection of data

Collection of official statistics

According to official reports from the state government of San Luis Potosí, the state territory has “spatial and socio-economic imbalances in rural and urban areas”⁵, so the main objective of gathering the regional data and develop the analysis is to identify where the resources are concentrated and to present an instrument to promote the development of this region.

Since 1983, in Mexico an autonomous agency in charge of collecting and organizing all the national information on statistics and geography was established; INEGI (National Institute of Statistics and Geography) was created to homogenize the legislations and functions of different organisms previously responsible for these tasks (INEGI, 2018).

The official national figures, this way, the national data are constantly being updated and their results are also shared to collaborate with different international organizations such as the Commission for Environmental Cooperation (to produce the North American Environmental Atlas), the United Nations (UN), the Organization for Economic Co-operation and Development (OECD), the Eurostat, among others.

From INEGI, official Mexican data will be collected, with the aim of knowing by official means in what situation the Altiplano region currently is; INEGI is currently the source with the most official data collection in the country.

⁵ Text from the Microregional Diagnosis of the Altiplano (SEDESORE, 2016).

The data collected will be related to the regional administration, the economic incomes, the infrastructure coverage for accessibility to the communities, and also data referring to the movement of these settlements within the region towards their basic needs, such as education, health facilities and food supplies.

It is intended a visit in the city of San Luis Potosí, where the state data of INEGI is processed, to know the available data and the process by which these data are collected and processed. The outcome of the current Altiplano region panorama, will show the main reasons for the internal affluences and also in which way the strategic connectivity is able to help covering some basic needs of this region.

Field research

Visiting the state of San Luis Potosi, the aims are two extend visits to the Altiplano region. The first trip will be focused on visit the northern part of this region, the route will start from the city of San Luis Potosí, going through the Federal Highway 57, towards Villa Hidalgo, Villa de Arista, going back to de Highway to Guadalcázar, Matehuala, Cedral and ending the journey in Catorce.

The second route for field research, will once again begin in the city of San Luis Potosí, but this time turning west to Salinas through the Federal Highway 49 (to Zacatecas), then returning toward Charcas.

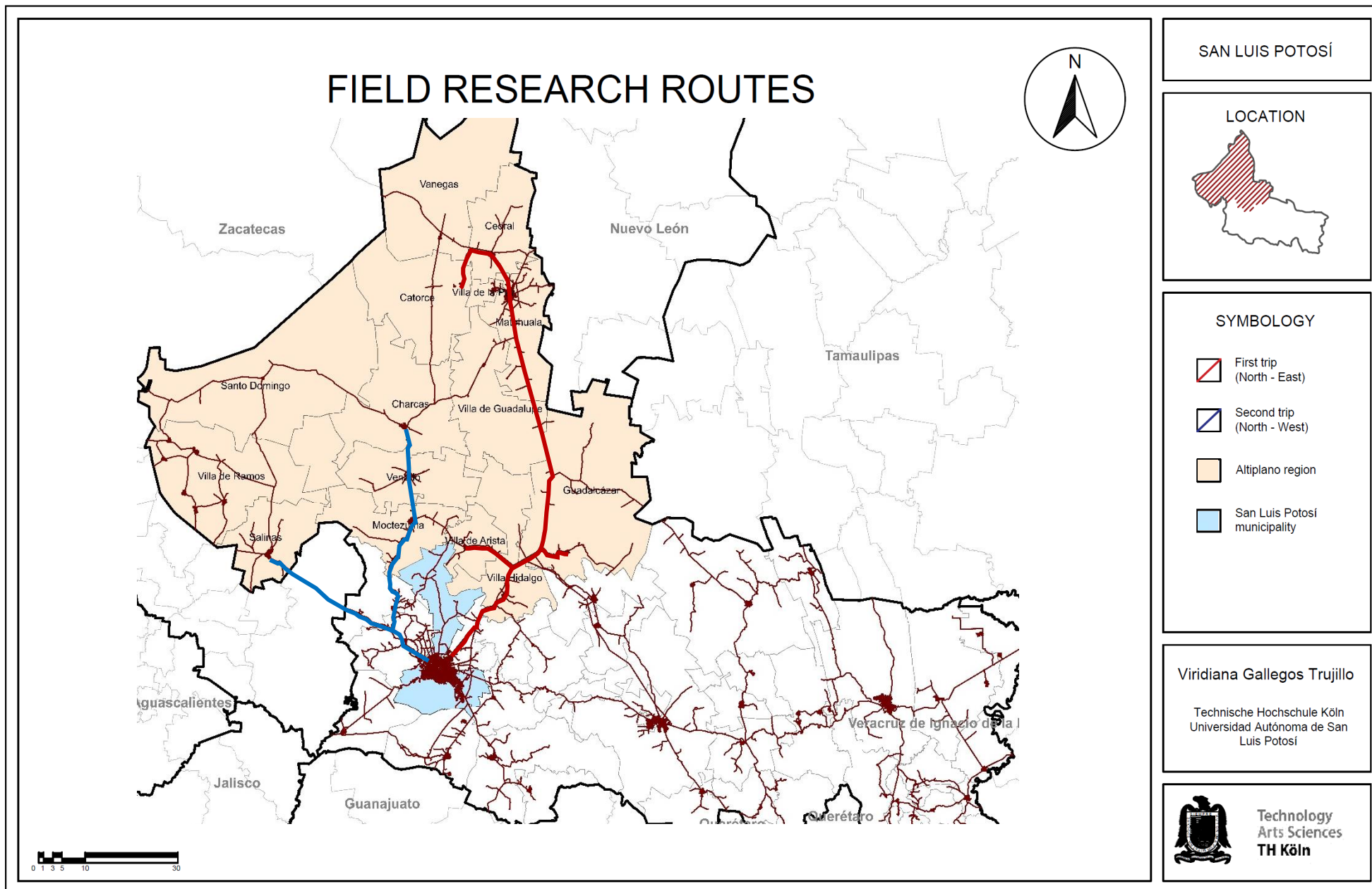


Figure 3.2 Trips traveled within the Altiplano region
Own elaboration based on federal data (ITER INEGI, 2016).

The first route was selected to cross the federal highway 57, towards the municipality with the greater concentration of population: Matehuala. Later on, it is intended to continue in the direction of Catorce, which contains high concentration of tourists; according to the State Tourism Secretariat, Catorce has about 70,000 visitors every year (SECTUR, 2015).

The second objective of these journeys is to go through the western territory of the region, starting with another main national artery, the called "San Luis – Zacatecas highway". The municipality of Charcas is located right in the center of the region and has a significant concentration of communities in its surrounding territory, so it is the next aim.

During the expeditions, the purpose to cover and physically know a wide extension of the territory of the Altiplano along these two trips, as well as to know a little about the culture and structure of the main population centers.

Interviews

Within the city of San Luis Potosí, the main offices of every state secretariat can be found; it is intended to get the principal ideas and thoughts of some state dignitaries from the economic sphere (SEDECO), the social sphere (SEDESORE) and the secretariat responsible for the physical communication network of the state (SCT).

Through interviews, the generalities will be to inquire about the accessibility by the secretariats towards the communities, as the flow and articulation of information and objectives from one organism to another and the instruments with which general decisions are made.

Each interview will be guided by stages; the regional perception, the current regional projects and the future projections by these organizations.

The first part will be used to know the perspective the public regencies have about these fifteen municipalities and the development as a region. The second part of these interviews, will lead us to the current processes that are being executed to develop and reinforce the connectivity for the communities. Finally, the questions will focus on the projections that have and the validity of the aforementioned projects, if their continuity is assured and the strategies that will be followed.

As a basis for each interview, the questions will be slightly adapted to focus better on each secretariat. Likewise, the interviewees will be shown a printed map of the region (with the political division, the settlements and the road network on them) to ease the physical territory explanations, as well as the printed questions and topics to be discussed. Each interview will be recorded with the permission of the interviewees to be used as a support for this research (see appendix with questions).

3.4 Data analysis

As an addition to understand the vocation and identity of the region, historical records with information about the Altiplano population and its dynamics with the territory will also be analyzed.

It is wide known that the alterations caused by the Spanish colonies, generated a massive loss of knowledge about the endemic indigenous settlements; in any case, the culture remains, as well as the character of the inhabitants and the customs, therefore small parts of the past help us to constitute what is currently happening in the Highland Plateau region.

The documents reviewed are part of the “Historical file set of the state of San Luis Potosí”, set of data provided by the same municipalities, because as will

be mentioned later, the northern region of the state of San Luis Potosí not always was part of it and the official information of these municipalities were added to this set later. These files will also be complemented with those developed by the National Institute of Statistics and Geography (INEGI), which annually updates the records.

4 CASE STUDY: 'ALTIPLANO' IN SAN LUIS POTOSÍ

4.1 San Luis Potosí as part of Mexico

Mexico has 32 states and all together constitute a 1 964 375 km² territory. According to the German Statistics portal “Statista”, Mexico is the 14th country with the largest territory in the world (Statista, 2018) and as average, the country has a population density of 61 inhabitants/km².

Nevertheless, San Luis Potosí as a state is below the national average with 45. The Altiplano region, however, presents only 11 inhabitants per square kilometer of territory according to official INEGI figures in the last record of 2015 (INEGI, 2018), a low dense territory, compared, for example, with the more than 2,000 inhabitants per square kilometer presented by the city of Cologne.

For better organization of those 32 Mexican states, the national government has developed, based on physical and cultural factors, a division into macro regions, which represents an effort to agglomerate the states with similarities between them, in the following map, the division is represented.



Figure 4.1 Macro regions in Mexico
Own elaboration based on the federal administration (Mexican Republic Government, 2018)

Likewise, within each state, interactions and dynamics of different nature occur that cannot be perceived at a state level. These exchanges are clearly presented inside the territory of San Luis Potosí; since the state is a cultural and physical border between Mesoamerica and Aridoamerica⁶.

The "Northern Highland Plateau" belongs to Aridoamerica; a large region distinguished by its dry-desert climate and mining vocation; the northern part of the state includes clearly differences from the other regions of the state.



Figure 4.2 Northern Highland Plateau in Mexico
Own elaboration based on Bataillon (1993).

⁶ Aridoamerica is a territory of low humidity and a wide expanse of deserts, where most of its pre-Hispanic inhabitants were nomads. Mesoamerica has humid and warm climates where most vestiges of sedentary population have been found before the Spanish invasion (Mayans, Aztecs, Olmecs, etc) (Vela & Solanes, 2016).

This big region has these particularities due to the fact that it is located between two large mountain barriers, the Sierra Madre Oriental and the Sierra Madre Occidental.

4.2 The Altiplano region

In this way, the northern part of the state of San Luis Potosí, is called 'Altiplano' (Highland Plateau). This part of the state, is the least favored due to the quality of its soils, climate and scarcity of water (Bataillon, 1993). The region contains 15 municipalities and 342,903 inhabitants (INEGI, 2010).



*Figure 4.3 Catorce, San Luis Potosí
(Moon, 2017)*

According to national data, with 28,454 km², the Altiplano region covers the 45.54% of the of the state territory and Matehuala, the biggest urban entity⁷ produces about 7% of the state's gross domestic product (GDP). Matehuala where, according to the State Economic Development Secretariat,

the economic activity of the region is concentrated (SEDECO, 2016). This Secretariat (SEDECO), counts on the industrial zone of Matehuala to be expanded by 2021 and as a result, to generate greater incomes and develop the Altiplano economy.

⁷ A population in Mexico (INEGI) is considered rural, when it has less than 2,500 inhabitants, while an urban entity is where 2,500 inhabitants or more live in it.

The Altiplano is also part of a larger region called 'El Salado', which consists of an extensive region with natural salt deposits, which once a year provide large amounts of salt that are collected and sold. This region also includes territory of other states, such as Aguascalientes, Zacatecas, Durango, Coahuila, Nuevo León and Tamaulipas.

The first complex for the exploitation of salt, settled by Spanish workers in the lagoon 'Santa Maria', in the municipality of 'Salinas de Hidalgo'.



Figure 4.4 El Salado region

Own elaboration based on data from the Autonomous University of Nuevo León (UANL, 2018).

The San Luis Potosí Altiplano consists of fifteen municipalities, and as can be seen below, the population concentration in the east of this region, is remarkable; 63% of the total population growth between 2000 and 2015

(32,762 people), was presented in this Matehuala. As second and third place, also in this last fifteen years period, the municipalities of Salinas and Cedral presented an increase of over three thousand people each. On the other hand, six of the fifteen municipalities suffered from population decrease: Catorce, Charcas, Moctezuma, Santo Domingo, Villa de Guadalupe and Villa Hidalgo. As can be seen in the following map, population imbalance throughout the territory is evident.

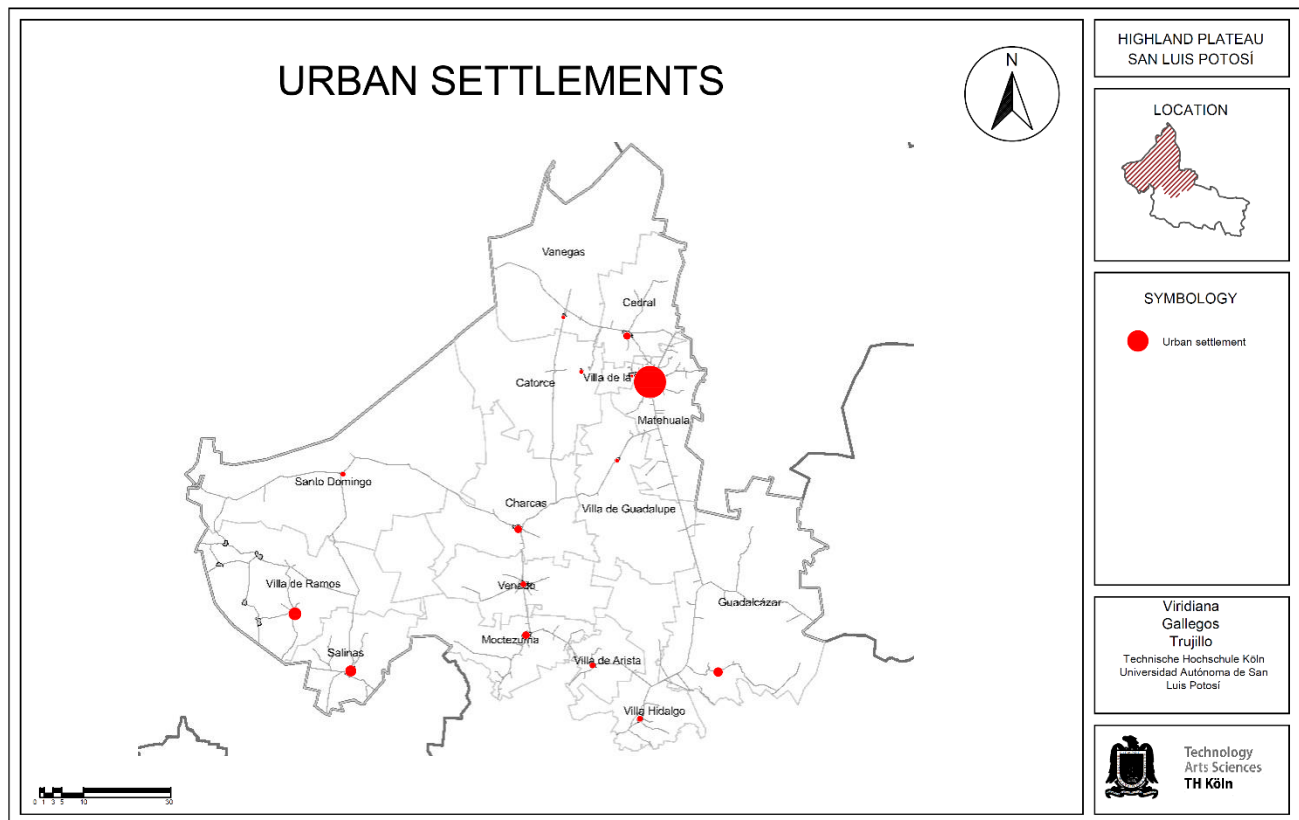


Figure 4.5 Number of populations in the Altiplano region
Own elaboration based on INEGI data (ITER INEGI, 2016)

As a method to delimit information, the Altiplano was subdivided into three 'micro-regions'. According to the Secretary of Social and Regional

Development of the State (SEDESORE), this micro-regionalization is reflected in best integrity, coherence and cohesion of public action; based on the dynamics recognition and the real conditions of its population, communities and municipalities. According to this Secretary, one of these regional subdivision main achievements, is the system of state and federal roads; being determinant for commercialization of products and efficient movement of physical and human resources (SEDESORE, 2016).

The Altiplano population is settled mostly along the region defined as East Altiplano and, according to state reports, in 2016, the West Altiplano microregion contained the lowest population density of all the state microregions.

As mentioned before, the population density of the Altiplano is 11 inhabitants per km², however, looking only into the western microregion, this figure drops to 8 inhabitants per km².

In Mexico, population censuses are officially generated every ten years, and every five years,

“counts” are generated in order to observe population growth rates and to know the direction the country is taking. According to these censuses and counts (the last count was taken in 2015), the population of six of the fifteen

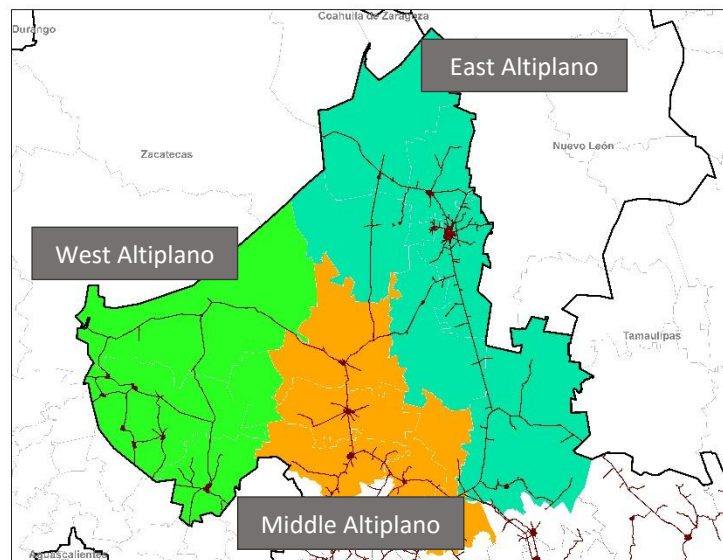


Figure 4.6 Altiplano microregions
Own elaboration based on State Government data (San Luis Potosí State Government , 2015).

municipalities of this region presented a population decrease, expanding the population polarization within the Altiplano.

Altiplano population 2000 - 2010 - 2015

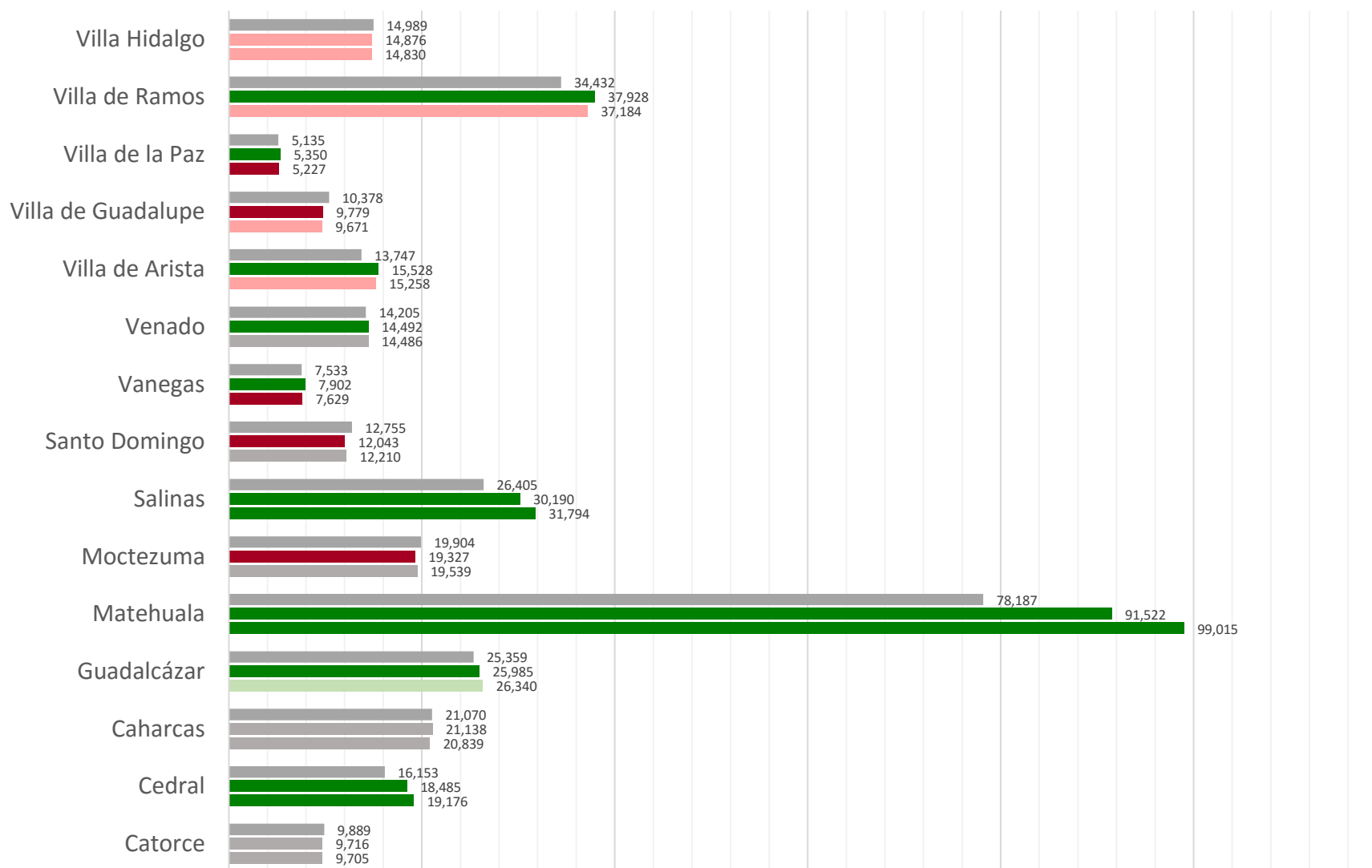


Figure 4.7 Altiplano population 2010 – 2015

Own elaboration based on data from the Economic Development Secretariat (SEDECO, 2017)

The graph, indicates the variations that have been presented in terms of the official number of the population every five years. The gray bars represent changes between 0.5 percent (+, -) of the population. With green color is indicated the increase of the population; in darker green, are the population that increased more than 2% in that five years. With red, on the contrary, the population that decreased is indicated, with a darker color also, changes of more than 2% are indicated.

In total, the Altiplano region represents a population growth from 2010 to 2015 of 10.5%.

4.3 Review of state and national historical documents: the development of the Altiplano

Throughout time, countless studies have been made on the effects that its history has on the population, formed through written, oral or iconic narratives, which are reflected in their individual and collective identity (László, 2014). Nowadays, there is a frequent decrease in identity referents generated by the constant migratory movements and the increasing ease globalization represents for mobility, therefore the representations of history are vital to shape the regional identity.

The collective memory and the historical materials are the foundation of this identity, since its interpretation tries to create common feelings and develop emotions of the individuals who are part of that identity. The inclusion of a historical approach to examine the identity of a certain population complements any investigation since it is based on popular behavior (Verdu, 2014).

As a principle of justice for the current reality, measures must be used to reconstruct and learn as accurately as possible the regional historiography, in order to interpret better the territory and the activities that are carried out within it (Morong R. & Sánchez E., 2006).

When someone sets out to study a topic within the colonial period in San Luis Potosí, it is easy to see that in the documentary level and the pursuit for sources, researchers face limitations and often discourage, when they perceive the dispersion of this information, as well as the inexistence of proper research instruments adjusted to the conditions of historical work in the entity (Montoya, 2013). As is known, the Spanish colonies developed cultural impositions that even today result in a difficult search of history and attempts to recover local indigenous customs.

The truth is that knowing the past of the Altiplano region is a challenge due to the lack of information presented. Then, however, it is presented from the most reliable sources, what is known about the historical development to the present day.

The region and its particularities

According to the State Historical File of San Luis Potosí, the population that inhabited the region before the Spanish conquest, were indigenous nomads, called Guachichiles, an ethnic group that lived in what is known as the “Big Chichimeca”, extension of territory named by Charles Di Peso (an American archaeologist) in 1979.

The studies referring to the Chichimec groups, include all a shared aspect: the persistent conceptualization of these cultures in relation to the pre-Hispanic cultures of central Mexico; the archaeological studies are directed towards the ethnic groups like generic characters without face, traditions or culture,

subject to the political dispositions of that time and presenting resistance by its same wild condition and nothing else (Zapata R., 2013).

Since 1550, took fifty years for the Spanish regime to submit the Chichimeca population. Due to their protective and nomadic nature, they faced the bloodiest conquest undertaken by the regime of New Spain (Powell P. , 1996). This conflict occurred because the interest of the Spanish people in the mining exploitation; issue that altered the borders that were in force in prehispanic time.

Subsequently, separate settlements were created for the indigenous people and Spanish population (Powell, 1945). The reports made for the Spanish crown with the profits for silver mining, are the first official data giving us the reference to the mining and commercial vocation of the region (Montoya, 2013).

About municipal internal information, some post-colonial local data can be found along the State Historical File. The municipality of Charcas is one of the most important settlement during the colonial period of what now conforms the state of San Luis Potosí; this municipality though, was within the jurisdiction of the “New Galicia” and was not part of the civil and ecclesiastical demarcations of the capital city (San Luis Potosí).

As for Matehuala, some authors indicate the contradictions of its founding year, as its existence begins to be reported only through reports on debts, sale of mines, the Franciscan doctrine (catholic), reports of “Haciendas” and some Spanish and indigenous settlements. About Catorce, it is indicated that in the last period of the XVIII century, the date of the foundation of the mining town is situated.

The oldest information about Cedral's settlement dates back to the year 1726, although there is an idea of its foundation that is more attached to the work of the Franciscan missionaries to reduce the nomad population in 1795. The beginnings and consolidation of Cedral cannot be separated from the importance of Real de Catorce, around which, the town served as an articulation between the mining center and Matehuala (Montoya, 2013).

The Historical File of Salinas, includes documents from 1713 in relation to the production of salt. Also, in the neighboring state of Zacatecas, documents about Villa de Ramos, Matehuala and Charcas can be found, due the previous different regional borders.

The municipality of Moctezuma has its origins in the effort to settle the nomads of northern Mexico in the mid-sixteenth century; on the contrary Guadalcázar, due to its important mining centers, was founded in 1616 as an exclusively Spanish settlement of mining entrepreneurs.

The commercial trade was consolidated as the main economic activity of the Altiplano region in the 18th century, once mining lost its strength as an economic boost.

More recently, in the 1980s, INEGI produced a document indicating all the particularities by state within Mexican territory. Within this report, it is already pointed out the important concentration presented in the capital of the state and how, "the most favored economic region of the state, besides the city of San Luis Potosí, is the Huasteca" due the oil extraction that takes place in some municipalities of the state (Ébano and Tamuín).

Within the Altiplano, on the other hand, the exploitation of gold, silver, zinc and fluorite mines is still being reported in Charcas and Catorce. From the records of that decade (1980), the extraction of minerals progressively

decreased giving way to the tourist attraction for its own mining identity and indigenous traditions. Matehuala and its surroundings, was also indicated as a rich area for agriculture.



Figure 4.8 Tourism in the municipality of Catorce (Moon, 2017).



Figure 4.9 Main square in Matehuala (Gallegos, 2018).

As can be observed, maintaining and rescuing the identity of the region is vital for its development, since the customs that the population presents are still belonging to a culture of survival and adaptation due to the relative lack of resources and the external pressures they have been exposed to.

It is understandable, that this region has a strong disparity among the other San Luis Potosí territories, since it has generally been identified over the years as a region with more affinity towards the northern territory of the country, while the center of the state is more identified with the center of the republic. These differences are disadvantages for the region; the state standards do not cover the particularities of the Altiplano as a mining, tourist region and with a developed toughness towards the presented adversities.

After making a review of the trajectory the Altiplano region has followed to become what it currently is, we will see in the next chapter, how the region at the present time is in terms of economy, the physical structure within the territory and its population dynamics.

5 FUNCTIONAL GRID ANALYSIS OF THE REGIONAL SUSTAINABLE CONNECTIVITY

5.1 Economic indicators

According the last detailed report made by the state government (2017), the Altiplano region produced around the 6.4% of the state GDP; of the 2,814,616 population within the state of San Luis Potosí (2017), 12.7% is located within the Altiplano and around 47% of the state population is economically active⁸. Within this region, the rate of workers per municipality is as follows:

Municipality	Percentage of economically active population		
	2010	2015	Contrast
1. Catorce	47.07	40.89	-6.18
2. Cedral	47.66	44.11	-3.55
3. Charcas	46.54	44.54	-2.00
4. Guadalcázar	44.9	28.39	-16.51
5. Matehuala	52.06	50.99	-1.07
6. Moctezuma	44.37	31.59	-12.78
7. Salinas	45.32	35.26	-10.06
8. Santo Domingo	38.57	26.27	-12.30
9. Vanegas	45.73	39.18	-6.55
10. Venado	45.64	37.34	-8.30
11. Villa de Guadalupe	43.3	32.11	-11.19
12. Villa de la Paz	47.92	44.8	-3.12
13. Villa de Ramos	41.63	21.34	-20.29
14. Villa Hidalgo	43.76	36.14	-7.62
15. Villa de Arista	47.91	36.57	-11.34

Table 5.1 Percentage of economically active population (SEDECO, 2017).

⁸ Population participating in the generation of some economic benefits.

As can be seen, the percentage of the economically active population in the Altiplano has decreased in the last decade from 1.07% in Matehuala, to even a 20.29% in Villa de Ramos (SEDECO, 2017). The Altiplano population, produces therefore 79,878 MXN as GDP per capita (around €5,916).

In the employment field, within the entire state, the highest percentage of employment is to the industrial area, as shown below:

Employment in the state of San Luis Potosí (2017)

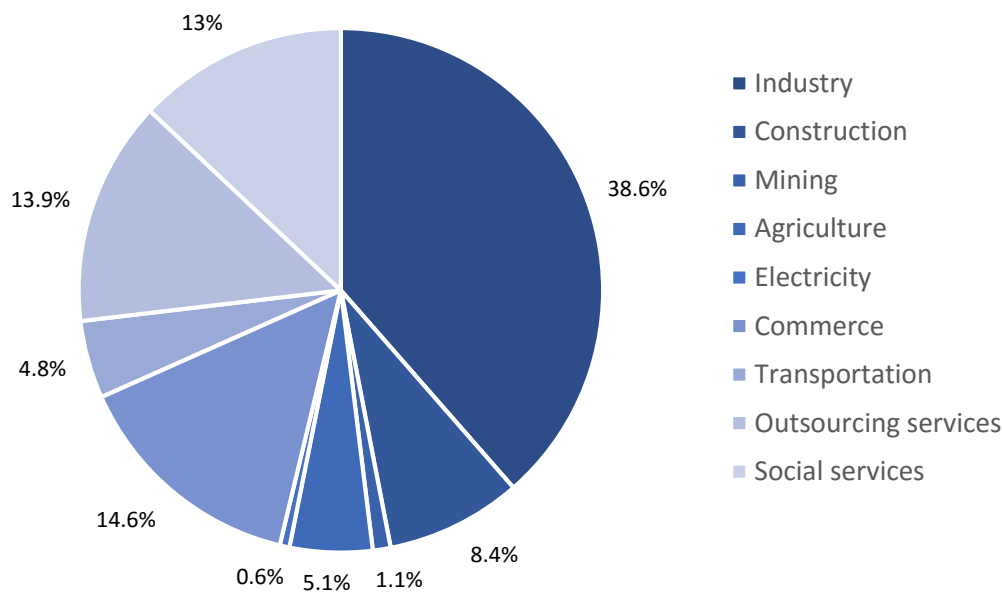


Figure 5.1 Workers insured according to their economic activity
Own elaboration based on data from the state government of San Luis Potosí (SEDECO, 2017)

As can be seen, the industry is the area in which most people from the entire state of San Luis Potosí are employed, however, within the Altiplano region, the scenario is quite different.

According to state government reports, is the main economic exchange center of the region is Matehuala (SEDECO, 2009). This city also is the main communication way between the city of San Luis Potosí and the north of the country.

Despite the different constitution of the Altiplano region for employment, within the state administration that took place in the years 2003 - 2009, the state governor created a legislative order authorizing to create the industrial zone of Matehuala, with a total area of 652,539.28 square meters.



*Figure 5.2 Industrial zone in Matehuala
(Gallegos, 2018)*

However, despite these impositions made by the state, the Altiplano continues to be a livestock, mining, agricultural region, and also in the last decade has also shown aptitudes for tourism. In livestock, the Altiplano municipalities breed cattle of free grazing. According to national statistics, 40% of this livestock is at least three old and the main profit from this breed can be seen below.

Reason for breeding	Percentage
Breeding of calves to sell	35%
Fattening cattle to sell	25%
Sale of milk products	2%

Table 5.2 Purpose of cattle breed

Own elaboration based on federal data (INEGI & SLP GOB, 2016)

The main municipalities that are dedicated to cattle breeding are Vanegas, Cedral, Matehuala, Charcas, Venado, Villa de Ramos and Salinas.

In the field of agriculture, within the region, continuous and seasonal mechanized agriculture can be found (Appendix D). The production in this region is green chili, red tomato, alfalfa, corn, beans, soybeans, wheat, sorghum, safflower, barley and peanut.

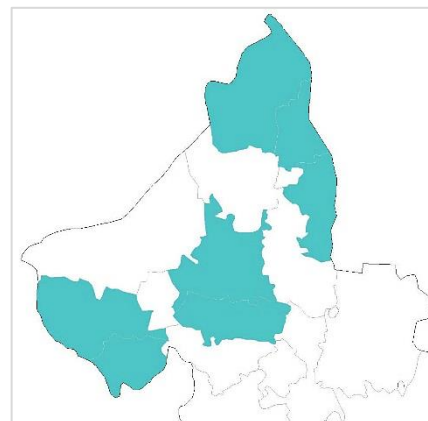


Figure 5.3 Municipalities that breed cattle

As mentioned before, the municipal capitals of the region were mostly established in those territories due to mining, so it is a deeply rooted activity in society even today, it is part of its daily life and traditions (Detailed mining location in Appendix C). During 2015, the following extractions were reported:

Mineral	Municipality	Tons extracted	Percentage of extraction within the state (Of that mineral)
COPPER	Charcas	3 216	11%
	Villa de la Paz	26 825	89%
GOLD	Villa de la Paz	1 085	24%
SILVER	Charcas	38 257	22%
	Villa de la Paz	90 618	51%

LEAD	Charcas	1 346	100%
PLASTER	Guadalcázar	119 395	21%
ZINC	Charcas	28 728	100%

Table 5.3 mining extraction in the Altiplano and its impact on the state (INEGI & SLP GOB, 2016).

Tourism has also been gaining strength in the last years, especially in the municipality of Catorce, due to its cultural, historical richness, the possible tours through old mines and the landscapes it offers, from the annually registered tourists, around 85% are Mexican.

Another important productivity sphere within the region is commerce. Villa Hidalgo, is the main honey producer of the state; during 2015, it was produced more than 204 tons. Likewise, the municipality of Venado is the only one in the state producing high quality wood from the so-called "Mezquite" tree, (*Prosopis laevigata*). Meanwhile, Charcas, Guadalcázar, Vanegas, Villa de Guadalupe and Villa Hidalgo, produce vegetal fibers to knit; within these five municipalities, was registered the production of 126 tons, 96% of the annual production.

As can be seen, the productivity of the Altiplano region is vital for San Luis Potosí, it is also highly diverse, complementing the activities made in the other regions of the state. It is also remarkable, that the region has high aptitudes to adapt to the scarcity of water and the dry desert climate it presents.

Due to the very particular nature of the region, it is necessary to preserve its practices and traditions, helping them on their own terms to develop, since the imposition of standards and the exploitation of the territory to address external interests, will certainly induce unfortunate consequences for this region.

5.2 Connectivity inside the Altiplano

Network structural changes

One of the first official records of infrastructure that San Luis Potosí has, indicates that the state, until December 1978, presented road network with total of 6336km, distributed into: 2 068 km paved, 3 290 km covered with concrete and 978 km of just soil. This network is equivalent to 10.04 km of road per 100 km² of territory (INEGI, 1985).

Within the maps made for this report, it is indicated that two highways go through the Altiplano: the federal highway 57 (from north to south) and the also federal highway 49, towards Zacatecas. As a secondary route, the

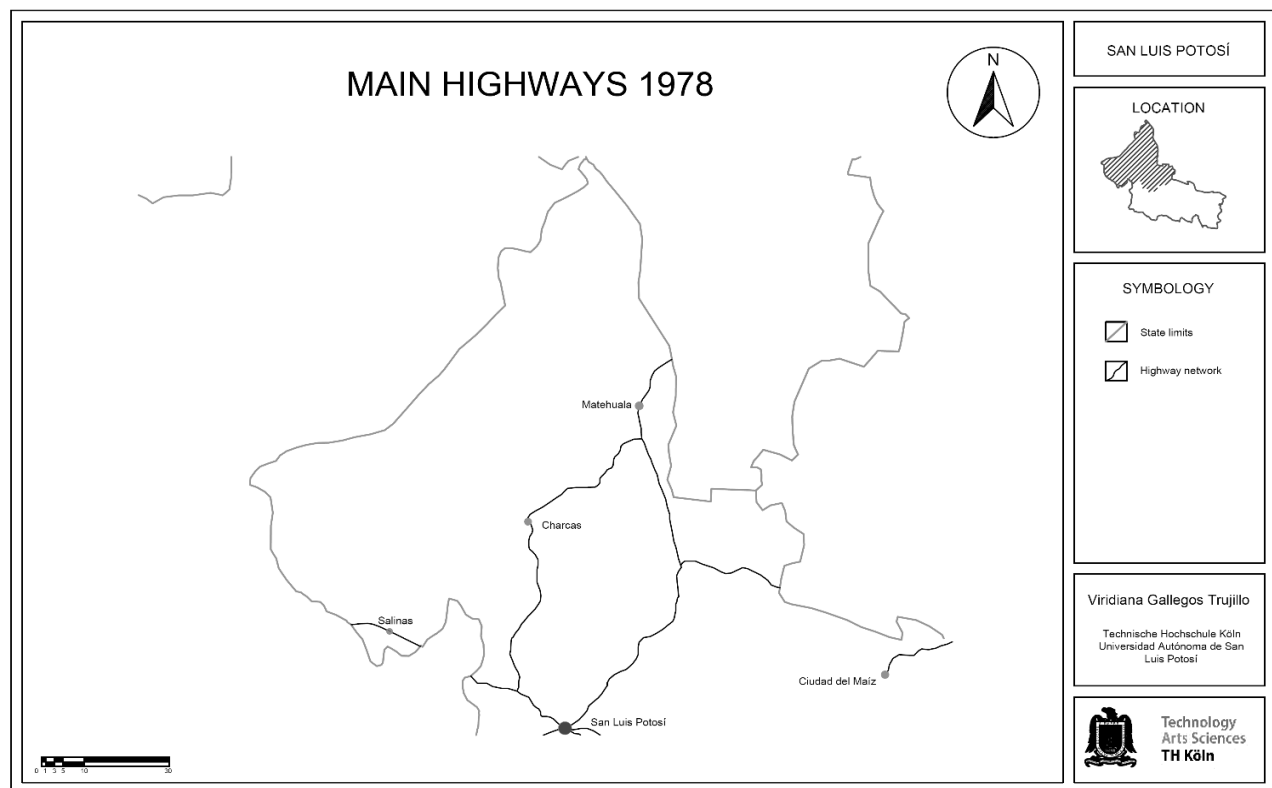


Figure 5.4 Main Altiplano highways in 1978

Own elaboration based on the Geographic synthesis of the state of San Luis Potosí, (INEGI, 1985)

importance of a "state road" connecting Moctezuma, Venado and Charcas is also remarked.

In around the last 20 years, the official information about the roads are made through mapping INEGI generates. The procedure of this mapping is to take GPS points and to separate all information by layers for its better management, the results presented by this institute are becoming each year more specific.

Because of the constant updating of tools and methods to generate these maps, a constant barrier to make proper comparisons of the physical development of the region, are the different data and information found in each report.

Initially, the results were presented by maps in PDF format, then they were published with a DWG extension and currently, the presented data is can be found in GIS format; the current maps are noticeably with a better quality; however, it is not possible to accurately know about the specific changes suffered by the road network in the Altiplano due to the different projections and scales each present.

In the following map, the different data produced by INEGI from 2000 to 2015 for the geographical study are shown.

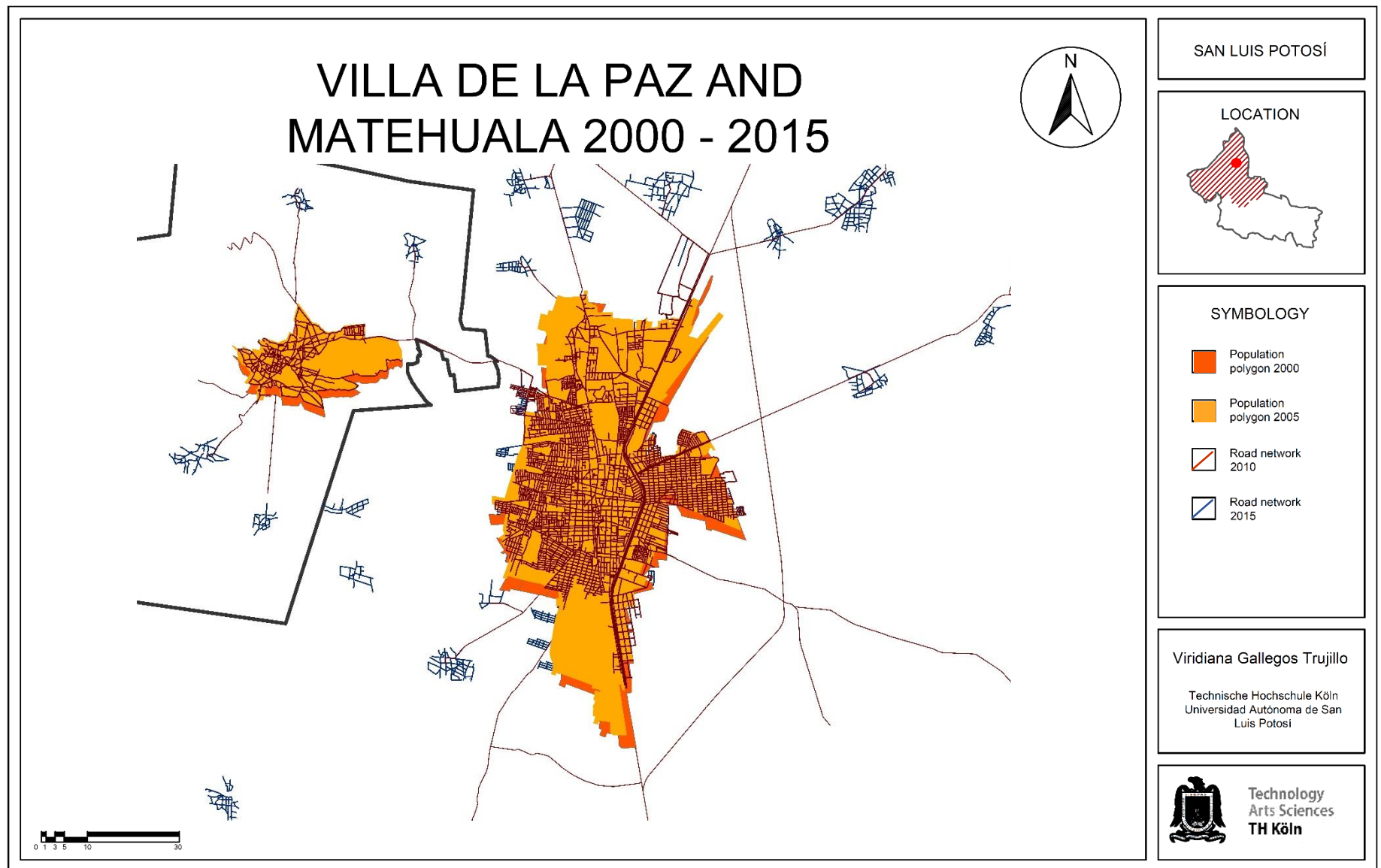


Figure 5.5 Different projections through the years (Matehuala)
Own elaboration based on federal data (INEGI, 2018).

The results are presented in different geographical projections, so they are not entirely compatible and do not match. Every five years, as shown, the information produced has been increasingly specific and accurate. The data currently presented for the highways and roads, contain directions and speed limits among their attributes, as well as their proper names and the scale at which they are being managed.

As it is also appreciated, the rural communities are now present in the maps, although without the precise information that can be found in the state and federal roads; it is expected that in the updated maps of 2020 include this new data.

It is noticeable, the wide efforts that have been made to complement the information for bigger results every five years and also to reform the data collection to achieve this objective, however, due to the diverse information and the dispersion found of the data, it is not possible to generate a proper observation of the real growth of the regional road network within the Altiplano is San Luis Potosí.

Services inside the region and its accessibility

'Accessibility' and 'connectivity' have inevitably interrelated purposes, (Santos y Ganges & De las Rivas, 2008). The regional connectivity infrastructure guides growth directly; it confers this way access to the communities and the facilities within them.

The Altiplano region has basic services for its population daily life (health, education and food supplies), however, the importance of accessibility for the population to these health facilities, basic education and food supply, has been scarcely discussed so far by the specialists in connectivity and the authorities.

The entity that contains the lowest number of services (69) for its population is Villa de la Paz, however, its municipal seat presents conurbation with Matehuala, what could mean in this way the coverage of services.

Naturally, Matehuala has the largest number of facilities (537) for basic services, followed by the region's south east municipality Guadalcázar, with 464.

Municipality	Km ²	Population 2015	Facilities for first need services	Facilities/Km ²	Facilities/population
Catorce	1,949	99,015	209	0.107	0.002
Cedral	1,172	37,184	200	0.171	0.005
Charcas	2,162	31,794	242	0.112	0.008
Guadalcázar	3,755	26,340	464	0.124	0.018
Matehuala	1,308	20,839	537	0.411	0.026
Moctezuma	1,283	19,539	289	0.225	0.015
Salinas	1,734	19,176	236	0.136	0.012
Santo Domingo	4,333	15,258	217	0.050	0.014
Vanegas	2,806	14,830	166	0.059	0.011
Venado	1,304	14,486	226	0.173	0.016
Villa de Guadalupe	1,917	12,210	219	0.114	0.018
Villa de la Paz	144	9,705	69	0.479	0.007
Villa de Ramos	2,498	9,671	260	0.104	0.027
Villa Hidalgo	1,500	7,629	226	0.151	0.030
Villa de Arista	588	5,227	147	0.250	0.028

Table 5.4 First need services within the Altiplano municipalities
Own elaboration based on federal data (ITER INEGI, 2016)

It is understandable when these results indicate that the facilities do not completely cover the territory, since the Altiplano represents a low population density and the territory is quite extensive, however, when the data related to the population number is observed, the region present not enough infrastructure for basic needs.

On average, for every 63 people, there is a basic service within the Altiplano; if we see it in perspective, to provide a population in a given territory with a

food facility, a basic school and a hospital, these would need to supply a total of 189 people.

Later, to continue with these considerations, the territorial coverage of these facilities and its catchment area divided by categories, will be analyzed to have a detailed breakdown of the population needs in this region.

The map presented next, shows the location of these facilities registered by the end of 2017.

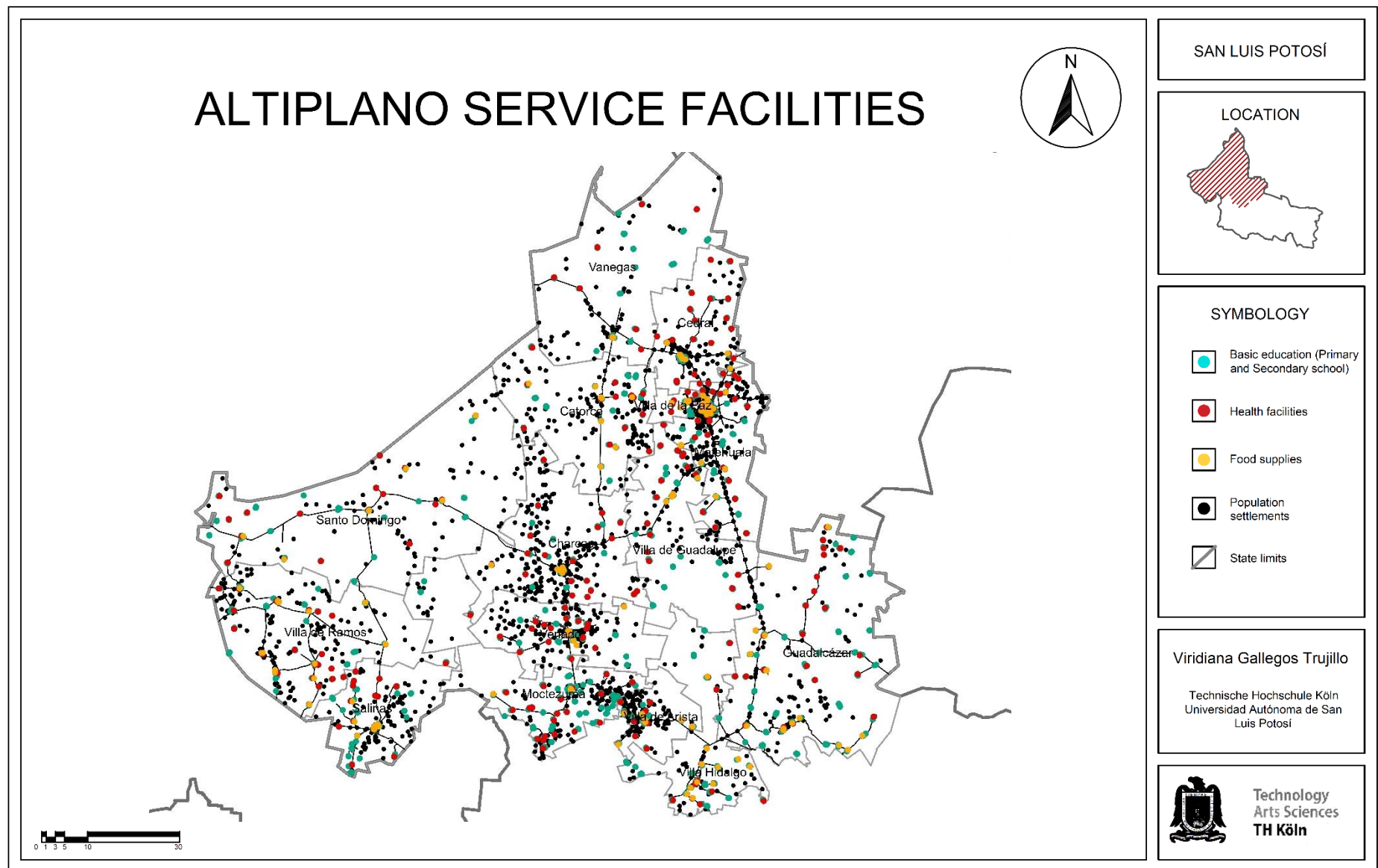


Figure 5.6 Infrastructure for accessibility to services within the Altiplano
Own elaboration based on official federal data, (INEGI, 2018)

Certainly, the greatest number of services can be found in the entities with more population, such as Matehuala, Salinas, Charcas and Venado. It can be seen, however, that information gaps exist on the communication routes that physically connect these facilities and the population.

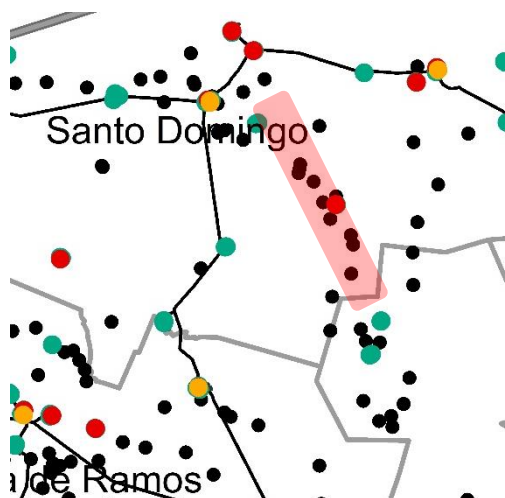


Figure 5.7 Accessibility to services in the Altiplano
Own elaboration based on official federal data,
(INEGI, 2018)

This undocumented infrastructure are commonly dirt roads through which some communities are connected; the inhabitants of these settlements within the Altiplano have to go these routes mostly walking or by horse. In this way, some services within the region present difficulties for access to the population not only with disabilities or older people, but in general.



Figure 5.8 Dirt road to an ISSSTE⁹ health facility (Gallegos, 2018).

⁹ Institute of Security and Social Services of State Workers (Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado)

Taking as a basis that accessibility is proximity or distance, the relationship with transportation system that allows to bridge the distance, the effort needed in time and cost, and the relationship with the activity in which the individual takes part (travel reasons) (Santos y Ganges & De las Rivas, 2008), communities far from the main federal communication channels are deprived of these services.

5.3 Mobility

Mobility depends on several issues, including access opportunities to goods and services, provided by the context the population lives in. When these needs cannot be fully covered, the probability of families presenting the need of migration increases, and as a consequence, profound changes in social composition are generated (Molinatti, Rojas-Cabrera, & Peláez, 2014). This way, the territory is abruptly modified and imbalances may appear if there are not enough planning tools to avoid it.

In the case of Latin America, cities have a deep social inequality, due to the concentration of resources in only some sectors (Molinatti, Rojas-Cabrera, & Peláez, 2014).

Regional transfer time

Within the Altiplano region, different types of road administration are conceived: municipal, state and federal. Of federal order, is the highway 57, crossing the Altiplano from Villa Hidalgo to the north, in Matehuala. With less extension but also federal, is the highway 63, which crosses the region through the center, from Moctezuma to Villa de Guadalupe. Likewise, a small part of the highway 49 also goes through this region, which only crosses the municipality of Salinas.

From state administration, there are roads complementing the coverage of the major federal arteries. With smaller sections are the roads in the municipal level, which are mostly congregated for internal mobility. According to the Road Regulation and Federal Jurisdiction Highway Regulations, the speed limit for federal highways is 100km/h and in urban areas it is reduced to 50 (SCT, 2012). Inside the state, the speed limits are expressed less clearly; the state roads, on average have a limit of 80Km/h, and for the municipalities, it oscillates between 60 and 40Km/h.

The state road coverage of infrastructure for mobility is the widest with 937,898 kilometers of paved roads of two and four lanes. While the federal highways cover 584,616 kilometers; these are also completely covered with pavement and of two or four lanes.

The municipal roads, however, have 5,251 kilometers (officially registered) so far and this information is different inside the database; these are one or two ways roads and there is no record of the material which they are made of.

The infrastructure is concentrated along the municipalities of Matehuala, Charcas, Venado, Moctezuma and Salinas, the imbalance suffered within the region in terms of infrastructure due the highway 57 is remarkable.

Within the following map, it is possible to observe the different roads that cross the territory of the Altiplano.

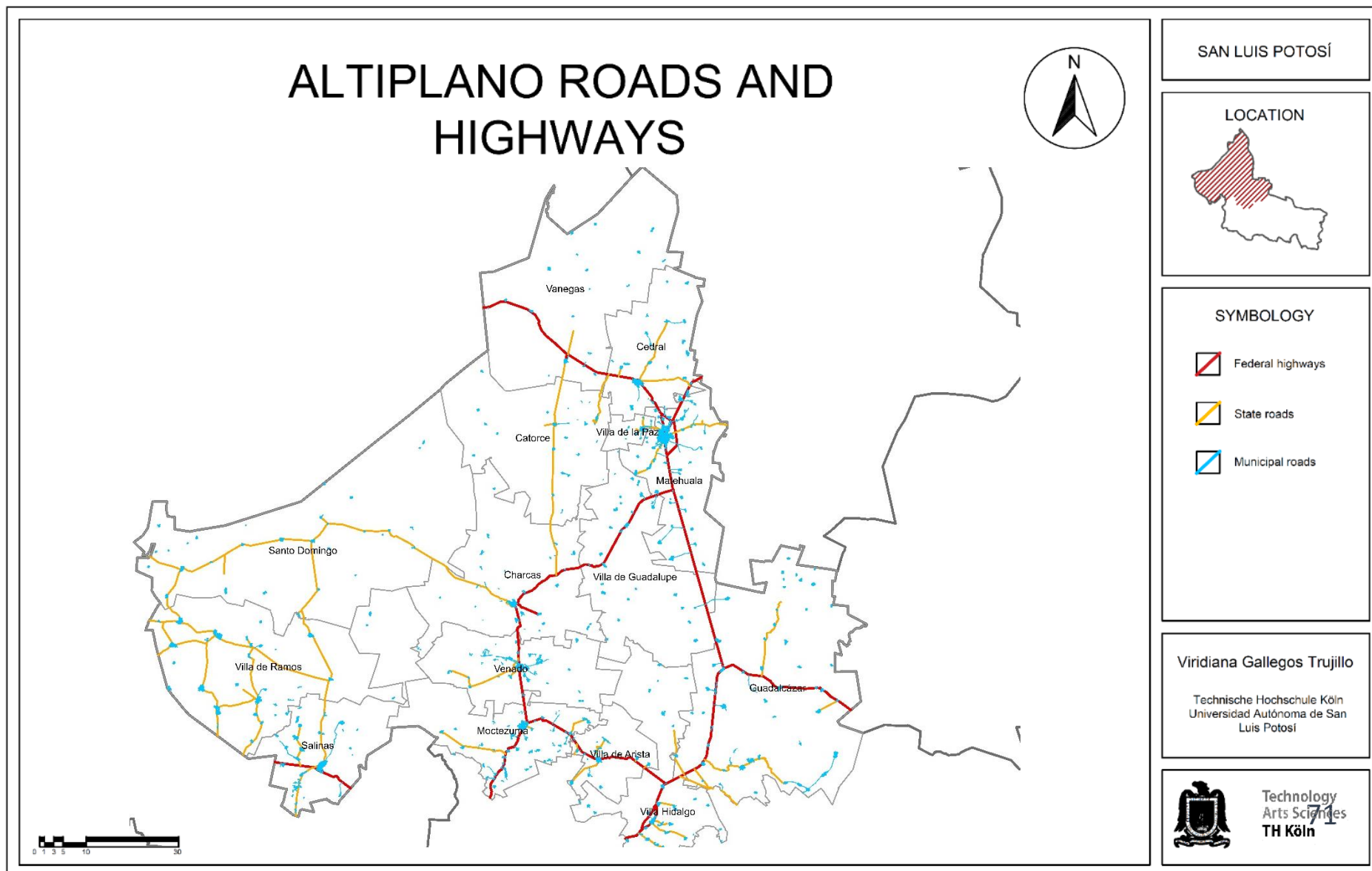


Figure 5.9 Road administration in the Altiplano
Own elaboration based on federal data (INEGI, 2018).

5.4 Functional grid analysis of the regional sustainable connectivity

Within this following section, we will analyze the relationship within the Altiplano region presented between the physical network for mobility, and the existent facilities offered to cover the basic needs of the population; the information processed has been provided by INEGI and updated this year; it is intended, to make an analysis as accurate as possible.

As previously remarked, the services within this particular region, are grouped along the highways 49 and 57. Likewise, the intention would not be to bring services covering parts of the territory that do not require it (without settled population), therefore, by calculating the distance between these facilities towards the population, will be observed if there are cases when communities without these services are found.

Basic education facilities

In some countries such as Spain, the United Kingdom, Canada or the United States, every year more organizations develop initiatives for students to choose better to walk to educational facilities instead of motorized transportation; according to some organizations, it is healthier, safer and cheaper (Kindsein, 2013). But what happens when some communities have challenges due to the inaccessibility to these facilities and the students must walk longer distances than recommended?

As a natural situation, underserved communities need particular attention. Transportation, planning and designing professionals, school communities, law enforcement officers, community groups and families, all have roles to meet the community's educational needs. To assure facilities for education in every community, data collection is critical to the planning, implementation and evaluation of programs (Safe Routes, 2018).

In a project initiated in Mali in 2006, with the support of the "Education Development Center" (a global association based in the United States), the attendance of elementary school children was compared by radios of distance between the community and the closest schools. The assistance was evaluated between communities that had schools within, those that had to travel up to two kilometers to reach them and those that were two to three kilometers away from the next school.

According to this report: "The data showed that school attendance declined dramatically when children were asked to leave their own community to attend school in another. In fact, for those villages without schools and situated less than two kilometers from a village with a school, school attendance was roughly half that observed in the villages with schools. For those villages without schools and located between two and three kilometers from a village with a school, school attendance was between one quarter and one third of that observed in villages with schools" (EDC, 2013).

Community - school distance	Percentage of kids not attending school due the distance
School located in the community	0%
Less than 2 Km	48%
2 – 3 Km	69%
3 – 4 Km	79%
4 – 5 Km	87%

*Table 5.5 Connection school location and attendance
Own elaboration based on EDC data (EDC, 2013).*

Understanding the thresholds above which young people are less likely to walk to school may inform local and national governments in making policy decisions regarding supporting active commuting to school (Chillón, Panter,

Corder, Jones, & Van Sluijs, 2015). It has been accepted that in primary education the children should be able to get to school in not more than 45 minutes. This transfer time corresponds to a maximum of about three kms on foot on level ground, of course less in mountainous areas, some 15 kms on a bicycle and about 30 kms in a car or a bus (Caillods, 1983).

As a result of a research made by UNESCO, the objective of creating ranges of physical distance between students and the facilities, is to identify different categories of situations from the point of view of accessibility. To understand this situation, the following table is presented:

Accessibility categories 'Students - Educational Facilities'		
Less than 1 km	-	Easy journey
From 1 to 3 kms	-	Reasonable journey
From 3 to 6 kms	-	Difficult journey
Over 6 kms	-	Unacceptable journey

*Table 5.6 Accessibility to schools (Daily walking distances)
Own elaboration based on data from Caillods, 1983*

As a method to observe the accessibility offered by the connectivity network within the Altiplano region for basic education, information was mapped for each municipality first without making any distinction between primary and secondary schools. This is education is considered the basic education and it's a constitutional right for all Mexicans.

In 2013, the so-called "Educational Reform" was approved by the Mexican federal government, which indicates that it is necessary for the basic education schools, to share with the federal agencies the details of their facilities, teachers and students. The reason for this openness of information is to "reduce the administrative burden on teachers and the administrations and

also to achieve a fluid communication" (Mexican Republic Gobierno, 2013), as a result, INEGI has been able to detail more accurately the data of these schools of basic education in the country.

In the 2015 national census, the complementary data about the educational level each school offer and the capacity of the students they manage, are reflected on the statistics; however, due to the urgency of this reform application, the complete data could not be entirely collected at the time. In the Altiplano region, these specific data are not yet found in the municipalities of Cedral, Santo Domingo, Vanegas and Villa de Guadalupe.

Within the following map, it is possible to observe the coverage the region has, in terms of basic education. By 2010, INEGI registered almost 64,000 children between 6 and 15 years old living this region, this age is the average to study primary and secondary school. For each basic education facility, the region has 265 children.

The lack of coverage by these educational facilities towards the population is evident, since the number of deprived communities is high. In this way, the effort to cover distances to get basic education lays on the communities themselves; it is possible to observe that if the radios of non-motorized displacement are extended to five and ten kilometers beyond an "Unacceptable journey", according to UNESCO.

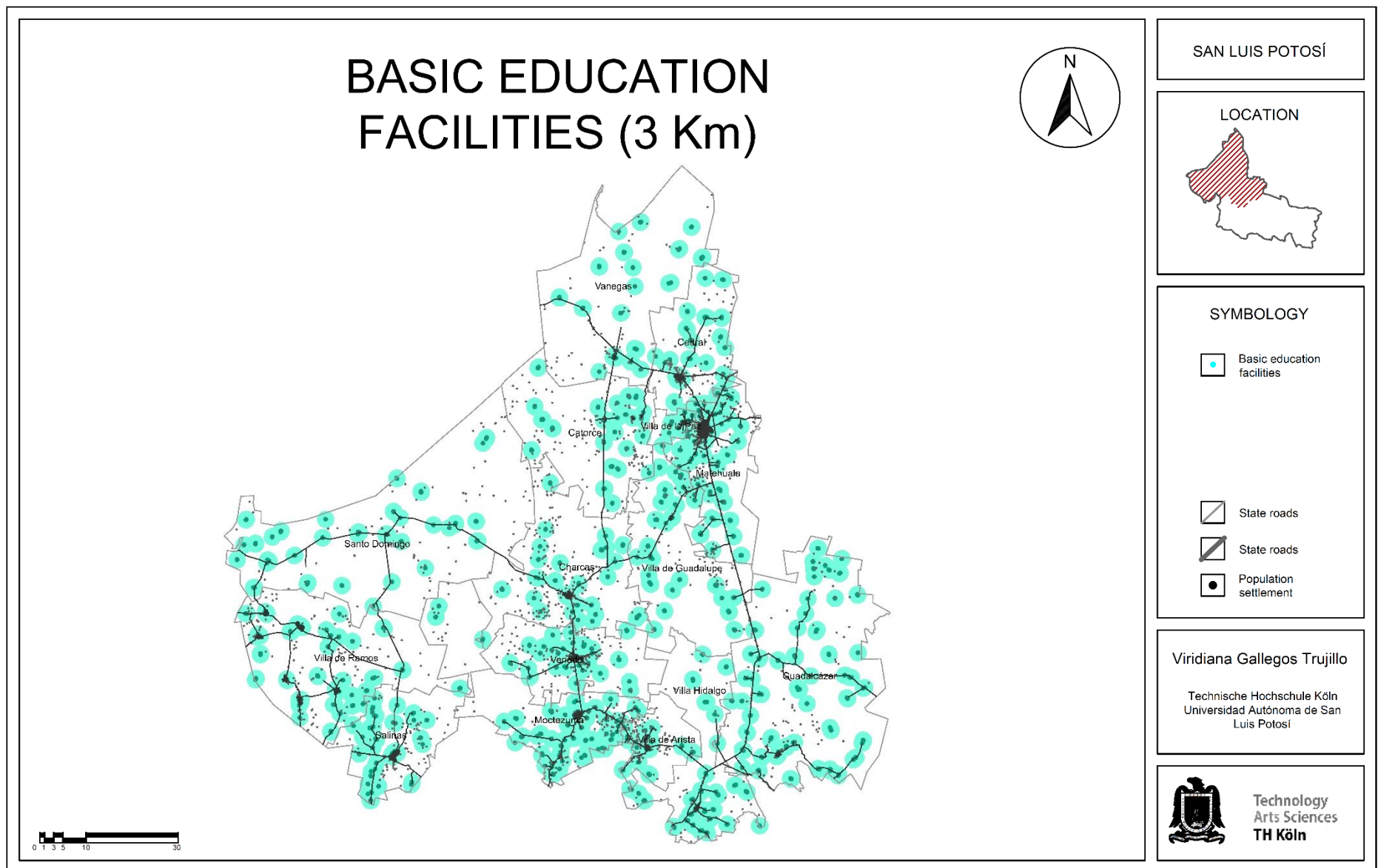


Figure 5.10 Basic education facilities catchment area (3Km)
Own elaboration based on federal data (ITER INEGI, 2016).

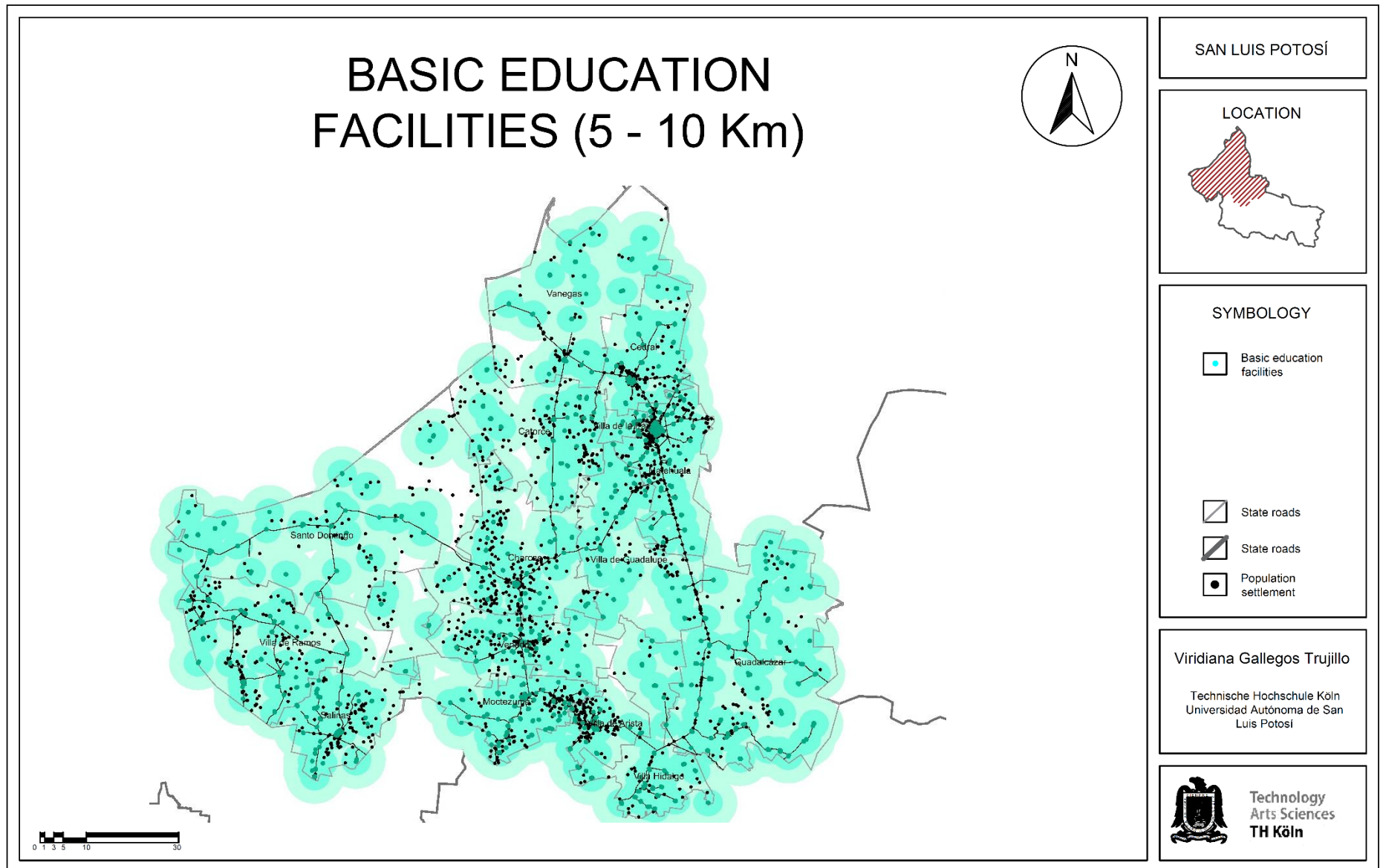
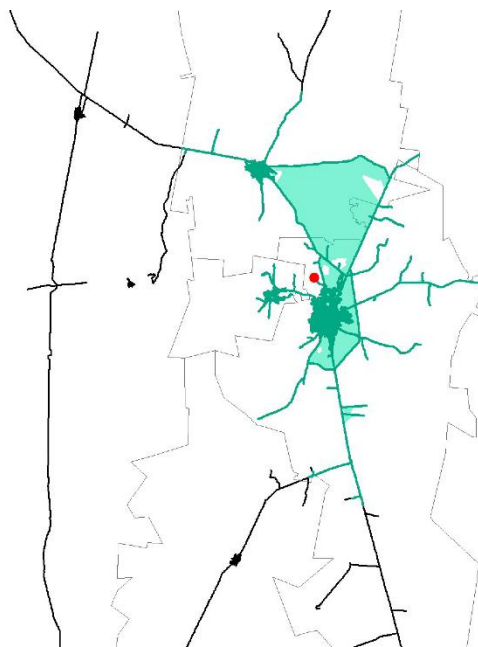


Figure 5.11 Basic education facilities catchment area (5-10Km)
Own elaboration based on federal data (ITER INEGI, 2016).

As mentioned before, it is possible to differentiate already in most municipalities between facilities for primary or secondary education; however, there are still not enough information in some municipalities due to the lack of data in some municipalities, it is possible, still, to observe the patterns followed in the coverage of each type of basic education can be observed.

Each facility has been processed according the distance of transfer; the results will show us the routes through the Altiplano road network that exactly cover 30km away from those schools. As can be seen in this figure, it is possible to identify from the central point (in this case the “Miguel Hidalgo” primary school in Matehuala) to each possible direction, 30km. In this way, communities that neither walking nor by road can easily access a basic school facility will be detected.



*Figure 5.12 Miguel Hidalgo primary school in Matehuala
Own elaboration based on federal data (INEGI, 2018)*

In the next pages, three maps are presented. Within the first, it is possible to observe the municipalities where it is separated primary education from secondary school, also, the municipalities when it is only indicated as "basic education".

In the second map, to know distances traveled within the physical network of the Altiplano to reach basic education, is indicated how much travel is required to be able to access a primary school within this region. These results are shown together with radios of five and ten kilometers away to access these facilities in a pedestrian way, in addition to the 30Km road distance. Finally, the same results for secondary schools are presented.

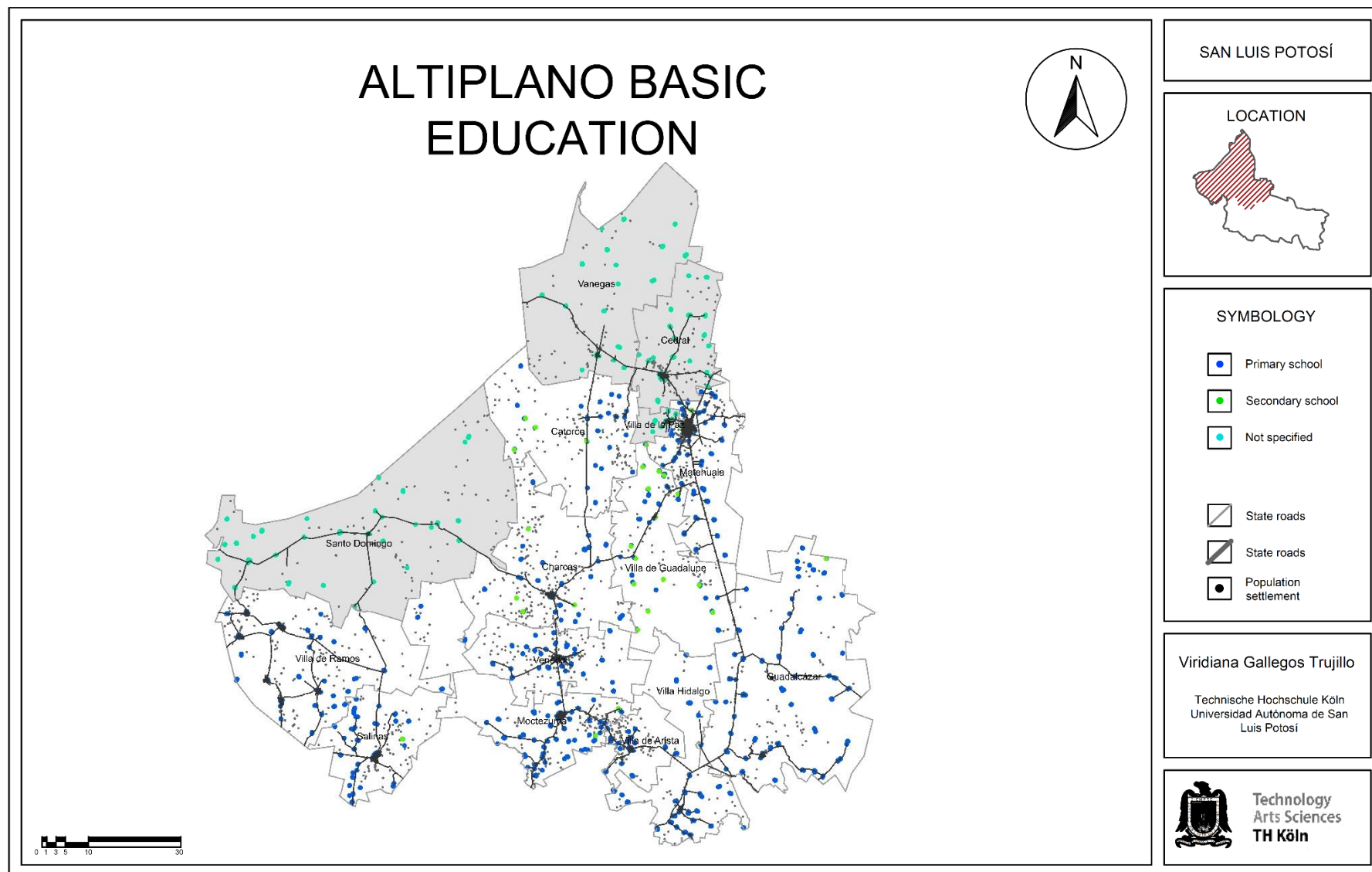


Figure 5.13 Basic education facilities in the Altiplano
Own elaboration based on federal data (INEGI, 2018).

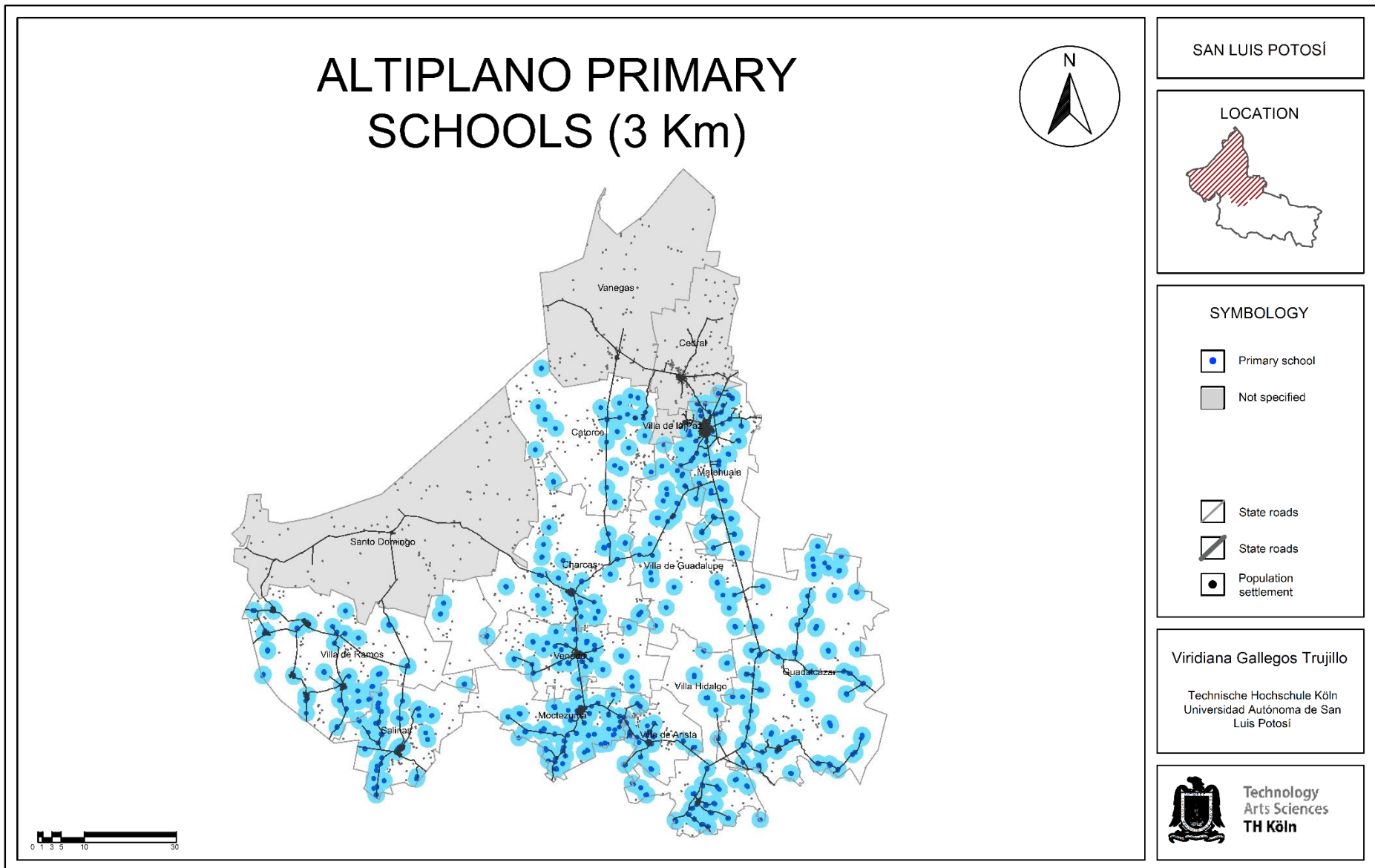


Figure 5.14 Primary school facilities in the Altiplano (3Km)
Own elaboration based on federal data (INEGI, 2018).

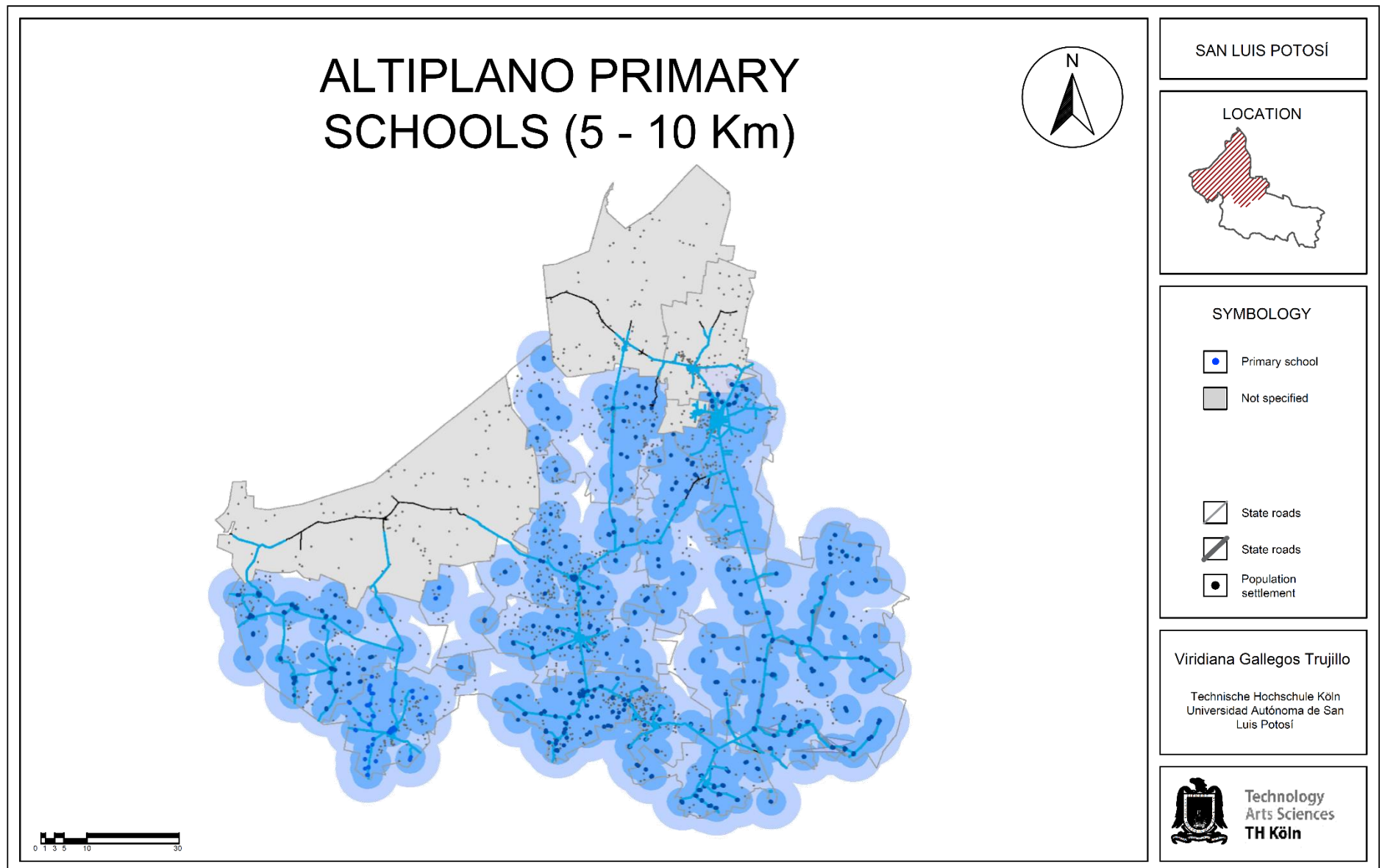


Figure 5.15 Primary school facilities in the Altiplano (5-10Km)
Own elaboration based on federal data (INEGI, 2018).

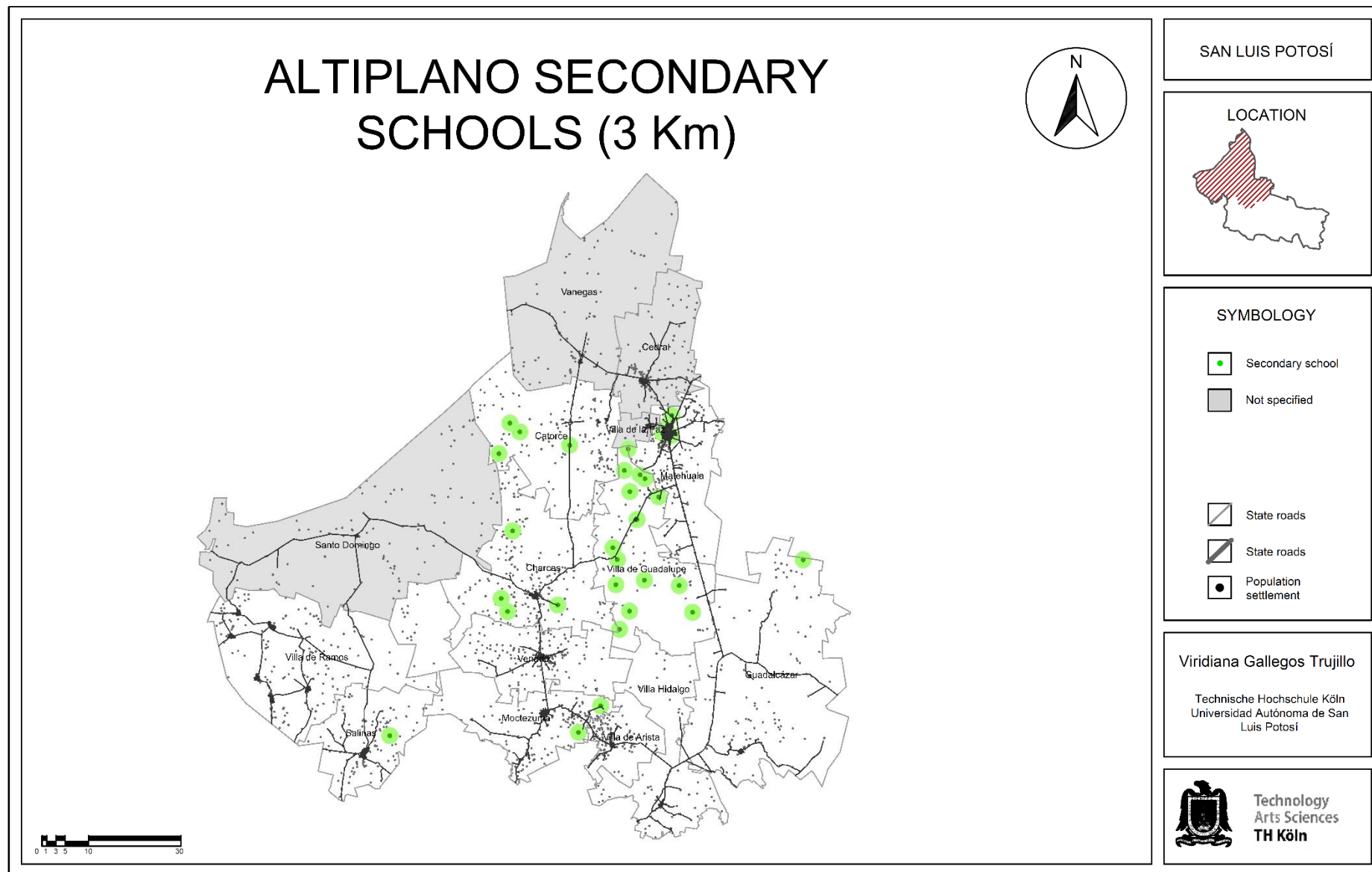


Figure 5.16 Secondary school facilities in the Altiplano (3Km)
Own elaboration based on federal data (INEGI, 2018).

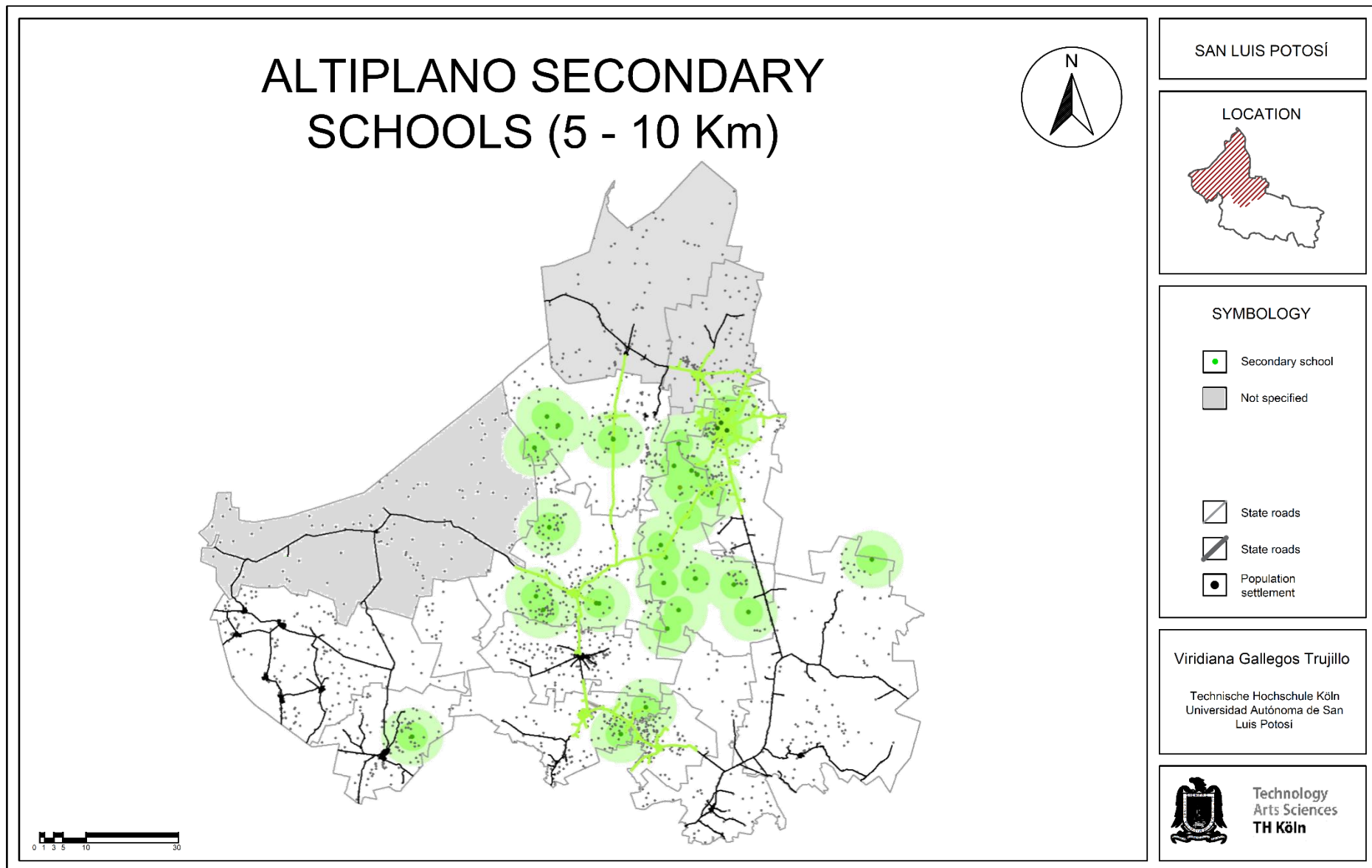


Figure 5.17 Secondary school facilities in the Altiplano (5-10Km)
Own elaboration based on federal data (INEGI, 2018).

In the first map presented, can be seen that the facilities that have not been defined as primary or secondary schools, are the municipalities of Santo Domingo, Vanegas and Cedral.

These main axes of federal communication, definitely generate an impact on the regional structure of the infrastructure for education distribution, however, due to the need of education, this kind of facilities appear, although with less density, within territory without apparent access routes.

It is also remarkable, the apparently usual location of schools for children from 6 to 15 years old, right on the roadsides of these highways, due the high connectivity this represents between these facilities and the population. It is necessary to rethink the access by different means so this does not represent a sacrifice of the population welfare for the right to basic education.

Another aspect reflected within the distribution of educational facilities through this territory, is that municipal division does not represent any kind of change in the distribution pattern, the decisions to settle the educational facilities, are evidently related to the road structure of the region, without presenting imbalances by municipal administrations.

It is evident the disparity the Altiplano comprehends between the number of primary and secondary schools for the population. The number of these facilities found, decreases drastically from primary to secondary; of the first ones, among the municipalities that specify the kind of basic education, is possible to find 911. However, the same graduated population that requires that number of primaries to be satisfied, only have 17 secondary schools.

From the almost 64,000 children between 6 and 15 years old living this region, 43,000 are between 6 and 12 years old, age to study primary school, meanwhile, the other 21,000, are between 12 and 15 years old; secondary school age.



Figure 5.18 Secondary school in Guadalcázar (Gallegos, 2018).

It is true that the current secondary school demand is lower than primary education, however, secondary is also constitutionally a right for every kid, so it is necessary to consider, that once finished primary school, these 43,000 students will need facilities to study further.

According to a study conducted in rural communities by the Education Development Center of the United States, when the geographic area from which children are eligible to attend a particular school gets bigger, the attendance is directly related.

Within this study, it was shown that the variability of children attending the school affected the percentage of students; because “enrollment of children living two to three kilometers from the school, dropped considerably in comparison to those living closer to the school” (EDC, 2013).

Health care facilities location

In Mexico, every healthcare facility needs to be certified and these facilities respond to an established federal government program; the specifications depend directly of the Presidency of the Republic. As compared to the experience worldwide, we see the Mexican medical services lagging behind in such regard. The lack of interest in understanding the culture of medical facilities, is based on the principles and values provided in the organization manual of each public and private medical institution, there are also other specific factors that negatively influence the health services for a population, like the number of these facilities and their location (Herranz, 2015).

Within the Altiplano, there are registered 308 health facilities:

Municipality	Population	Health Facilities	Population/HF
Matehuala	99,015	45	2,200
Villa de Ramos	37,184	26	1,430
Salinas	31,794	18	1,766
Guadalcázar	26,340	28	941
Charcas	20,839	25	834
Moctezuma	19,539	22	888
Cedral	19,176	22	872
Villa de Arista	15,258	15	1,017
Villa Hidalgo	14,830	15	989
Venado	14,486	20	724
Santo Domingo	12,210	18	678
Catorce	9,705	14	693
Villa de Guadalupe	9,671	20	484
Vanegas	7,629	9	848
Villa de la Paz	5,227	11	475

*Table 5.7 Population per health facilities
Own elaboration based on federal data (ITER INEGI, 2016)*

Certainly, the facilities of each health center have a different capacity number, however, regardless of the population number in each municipality, the number of inhabitants the facilities must supply with medical services, is very variable.

Despite being the municipality with the largest number of health centers, Matehuala has fewer facilities per inhabitant and yet (regardless of the quality of the facilities), countries such as Germany, Austria, Hungary, the Czech Republic and Poland have between 6 and 8 health facilities per 1,000 inhabitants, so by deduction, the number of facilities among the communities is not insufficient (OECD, 2016).

According to the latest OECD report in 2017, Mexico was below the average in terms of health care accessibility, since within the entire country, only 92 percent of the population has some kind of health insurance (mostly public assurance), below the 97% which is the average among all OECD countries.

Within this OECD analysis, it is also remarked, that for the population within the country, public expenditures for the facilities, the necessary instruments and the health service are far below what is necessary; only a quarter of what is recommended, which directly affects the life expectancy (OECD, 2018).

Within this context, the evaluation for accessibility for these services is necessary. In the following map, the territorial distribution of these facilities can be seen, along with the location of the population settlements.

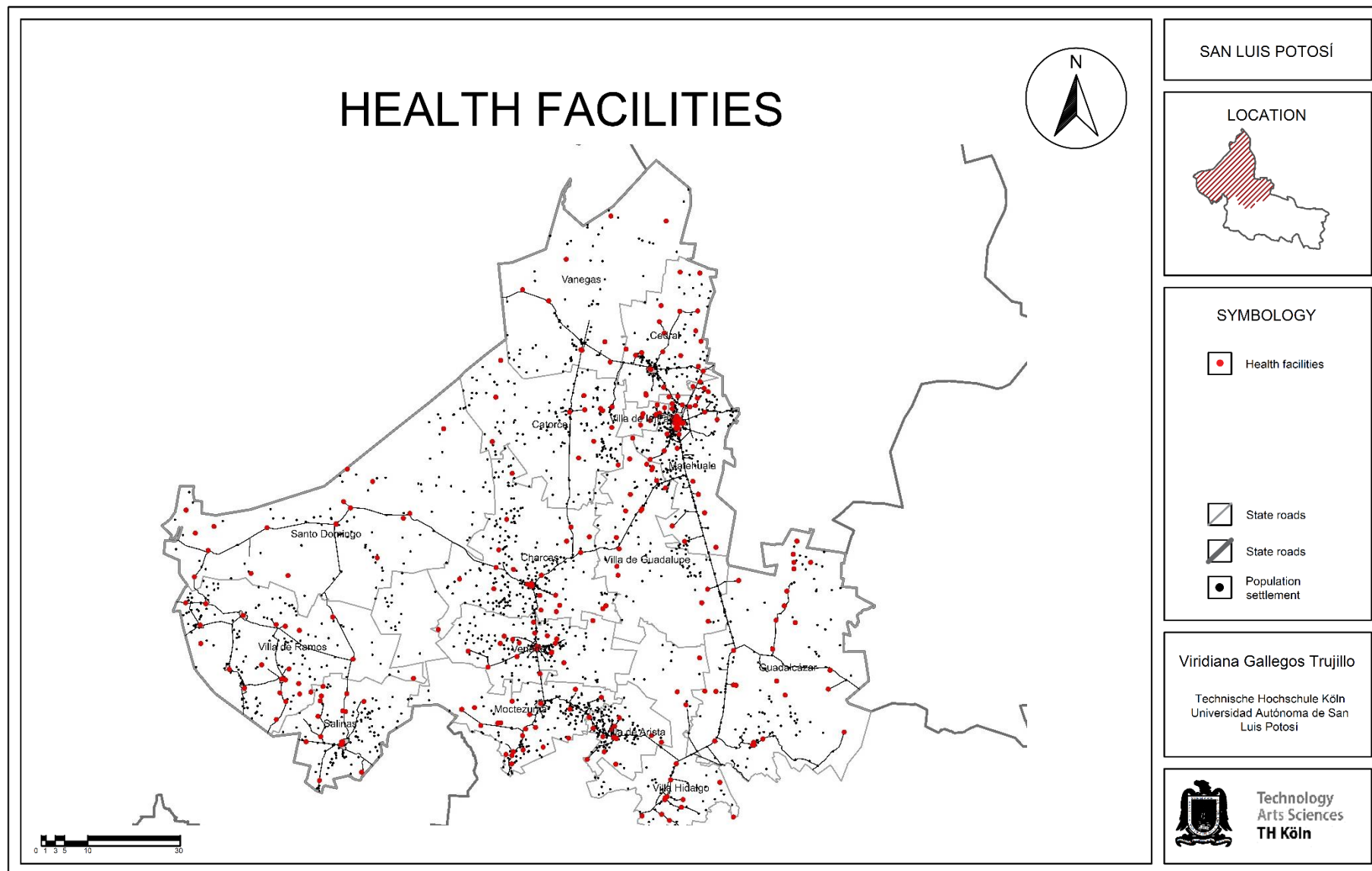


Figure 5.19 Health Facilities location in the Altiplano
Own elaboration based on federal data (INEGI, 2018).

Although there is no specific tool that indicates the influence radius of the health centers within the Social Development Secretariat in Mexico, the distances of 5 and 10 km were taken; these distances represent, on average, one and two hours walking for an average person, respectively. Within these buffers made around the health facilities, it was found that 98 population settlements require a longer distance than 10 km in order to access medical services.



Figure 5.20 Medical rural unit in Guadalcázar, San Luis Potosí (Gallegos, 2018).

The areas with most scarcity of facilities for health, are again those that are far from the national highways, in municipalities such as Santo Domingo, Vanegas and Catorce.

The health centers were projected in a database to recognize the communities located more than 30 km away by motorized means, as well as 5 and 10 km for pedestrians. The network of roads, indicates, with a full coverage of red

color, that once this road network is reached, there are not a section of this road network where no health facility is found farther than 30 km.

However, there are many facilities of this type that do not have access to this road network and the even more alarming results of these projections, are the 93 localities that were found without access to health care facilities; They are not within the radius of 10 km of proximity to these facilities, nor do they have easy access to the road network.

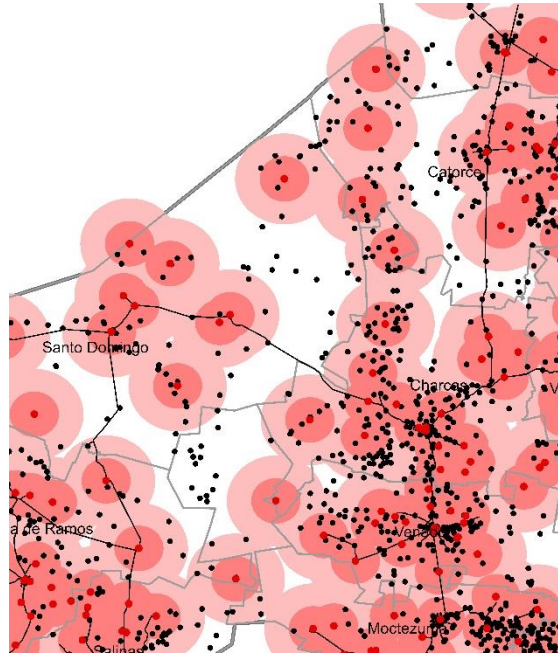


Figure 5.21 Settlements without connectivity towards health care facilities

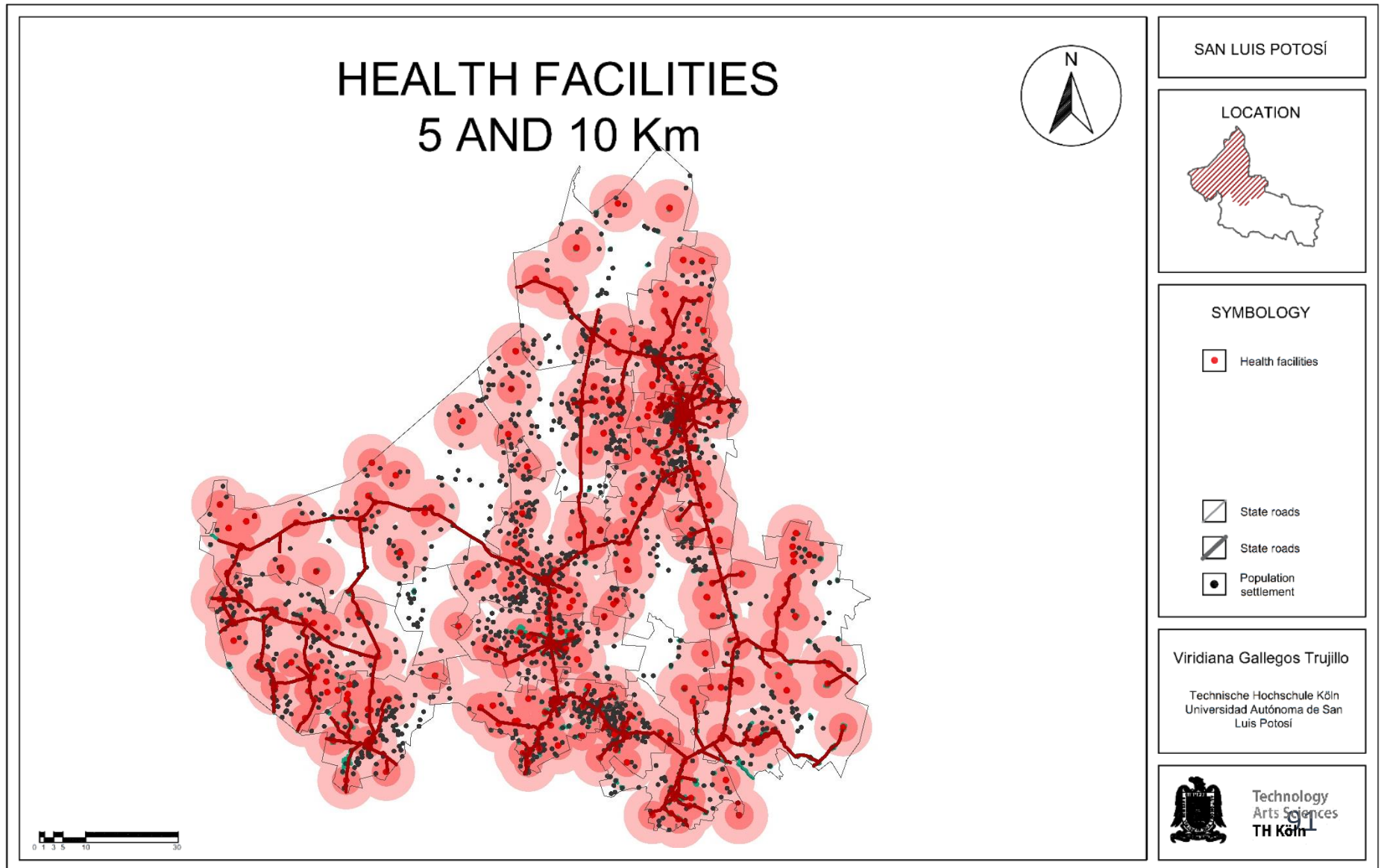


Figure 5.22 Distance between settlements and health facilities
Own elaboration based on federal data (INEGI, 2018)

Within this region, it is possible to observe the biggest health facilities gaps in the municipalities of Vanegas, Santo Domingo, the eastern part of Salinas and Catorce.

Food trade location

According to statistics from the state government, Charcas is the municipality with more communities presenting social gaps within the Altiplano region. This social gap is measured by access to health and education, the services each housing provide and food accessibility (SEDESOL, 2018); food supply facilities within each entity, are considered as “essential services” for the country.

As a response to some countries’ lack of accessibility towards food supplies in order to guarantee the vulnerable population welfare, the Food and Agriculture Organization of the United Nations, addresses the concept of “Food security”, which refers to stability, availability, utilization and accessibility for acquiring appropriate foods for a nutritious diet (FAO, 2006).

In Mexico, every six years since 2006, a National Health and Nutrition Survey (ENSANUT) has been made, to identify the conditions under which Mexicans eat, the usual difficulties presented to obtain food and the relationship between their diet and their health.

In the latest results developed in 2012, it was indicated that San Luis Potosí was the fifth state with more food insecurity for its municipalities. This meaning, about 8 out of 10 households in the state, faced some kind of adversity in order to feed themselves properly. 10.8% of the households, likewise, presented “severe insecurity”, which means they suffered hunger on at least one occasion in the three months prior to the survey. In the rural population this increase, since 14.3% of the inhabitants suffer from

malnutrition and low weight, compared to the 8% presented in urban entities (ESANUT, 2013).

To know the location of the facilities within the entire Mexican territory, INEGI, in its database, has information about these proper facilities for the food obtainment, which are denominated according to their scale and construction, as a Central of Supplies (Central de abastos), Market or Shopping Center (Centro comercial) according to INEGI. Presented in the following map, the distribution of these facilities throughout the region are presented.

Likewise, in addition to addressing the food supply needs for the population, there is also the opportunity to strength the local products quality and distribution, because as mentioned before, livestock and agriculture are some widely practiced activities within the region (see appendix D for more details about the agriculture location).

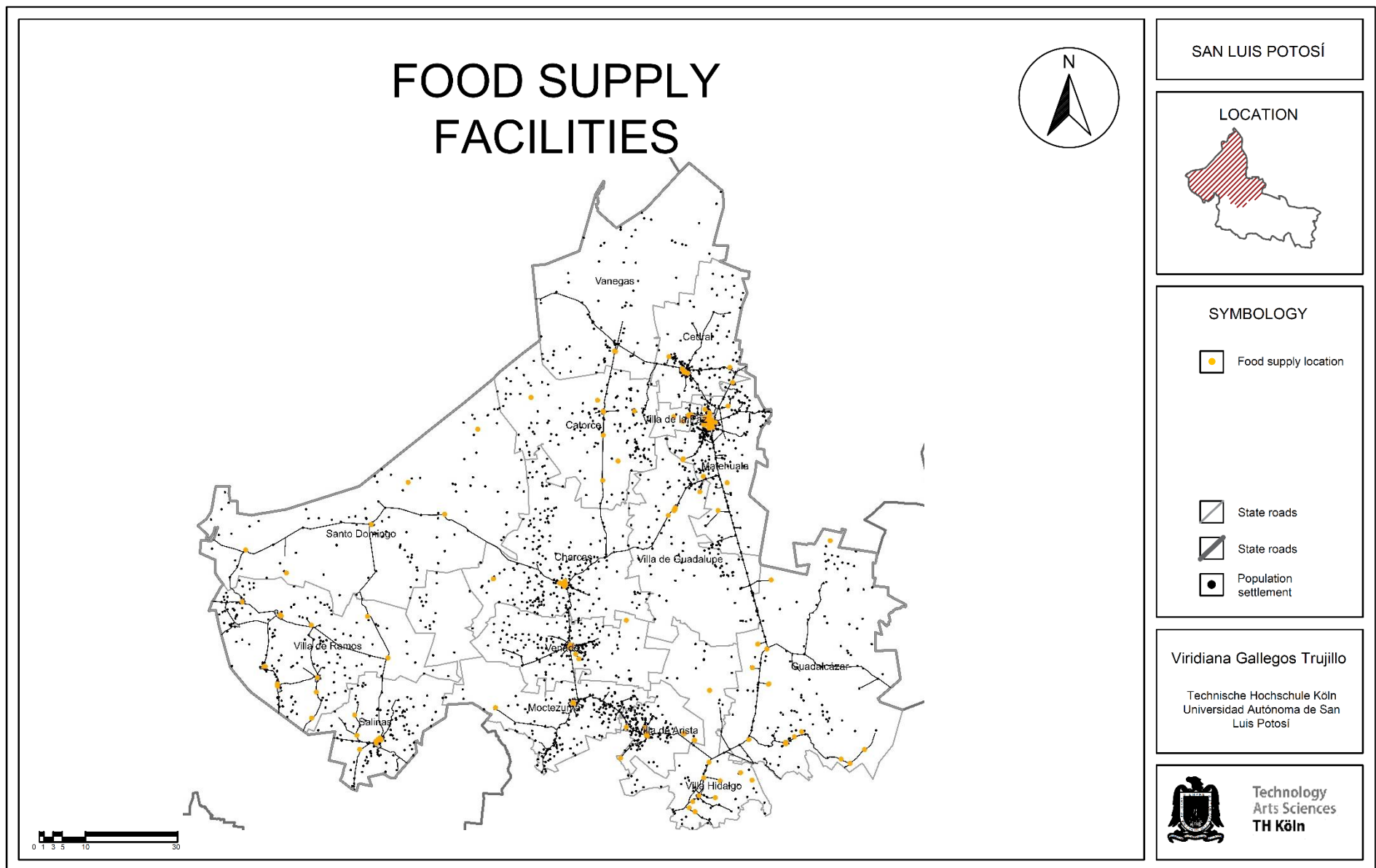


Figure 5.23 Food supply facilities location
Own elaboration based on federal data (INEGI, 2018).

The map shows that the location of these facilities tends to be once again, along these main roads and, as a contrast to what was observed in education and health, the number of these facilities and their distribution present different patterns within the different municipalities.

Vanegas, as an example, contains an only center in the main road cross it has, while on the contrary, Santo Domingo, presents a more equitable distribution of these facilities.

These facilities do not follow any strategical order to guarantee the supply of these services for the population, but apparently, they obey the demand is produced by the flow of people on the highways.

Through the network analyst tool, a study was made to observe the efficiency of the region in supplying food to the communities. As can be seen in the following map, municipalities such as Vanegas and Guadalcázar do not have direct access to these facilities, which means these communities are tied to consume almost exclusively what is produced in their own community, without ease for the exchange or purchase of different products.



Figure 5.24 Street market in Catorce (Moon, 2017).

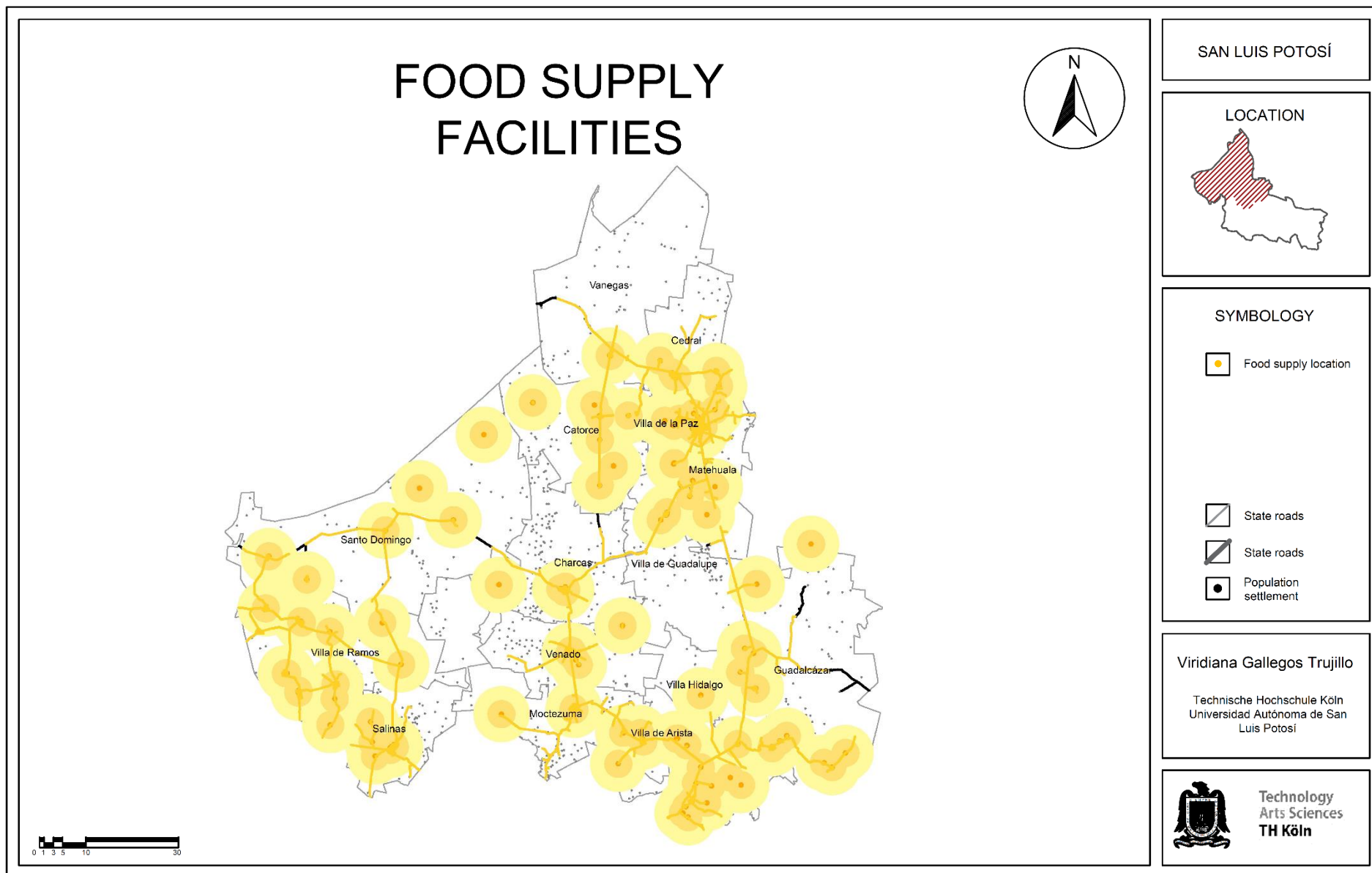


Figure 5.25 Food supply facilities location
Own elaboration based on federal data (INEGI, 2018).

The communities outside these catchment areas can be, surprisingly, found in each of the municipalities. The accessibility to this basic service is considered as an indicator of the social welfare of the entities, however, a concrete pattern to cover these needs of the population cannot be seen.

On the other hand, in addition to the lack of facilities and strategic distribution, the road network shows inefficiencies to connect these centers, by maintaining distances of more than 30 km away from facilities for food supplies, it is proven to be inefficient to cover these popular daily needs.

6 REGIONAL DEVELOPMENT IN THE ALTIPLANO

One of the main issues faced in every region is related to the difficulties of social actors in the search, organization, access, modeling, and interpretation of socio-economic data, especially in complex environments, generating needs that, although continued and urgent, often fail to take proper responses from policies and practices of public administration (De Carvalho & Fogliatti, 2016).

The State-community relationship is strengthened when both sides are able to articulate their interests and explore different methodological possibilities of studies for the benefit of each one (Morong R. & Sánchez E., 2006), although this open communication is not as simple as it seems, because the strategies chosen for it are not always the most appropriate; each society responds differently and each one certainly is sensitive to different kinds of stimuli and to the diverse actions proposed by the authorities.

At the end of the last century, when globalization began to spread in a generalized manner, it was accompanied by the idea of ungovernability, as a result of growing evidence of the inability of governments to respond to the multiple social demands that arose from the intercommunication tightness now on a global scale (Meyenberg, 2012). The current cities, face a lack of territorial order and homogeneity of service coverage for the entire population, the contrasts between the demands and responses obtained are increasingly evident.

One of the new challenges the government of San Luis Potosí faces, is precisely the global trade negotiation for new industries that decided to locate within its territory. According to national reports (INEGI, 2008), by the beginning of 2018 the state was in the third national position with the highest economic

growth related to the manufacturing industries. More than half of this manufacturing production comes from foreign companies such as BMW, Bosch, GM, ABB, Dräxelmeyer, Cummins, etc.

Since the beginning of the 21st century, a growing number of industrial companies have been concentrated within the state along the 'National Highway 57' (one of the main national arteries that goes from Mexico City to the border with the United States) which It is observed next

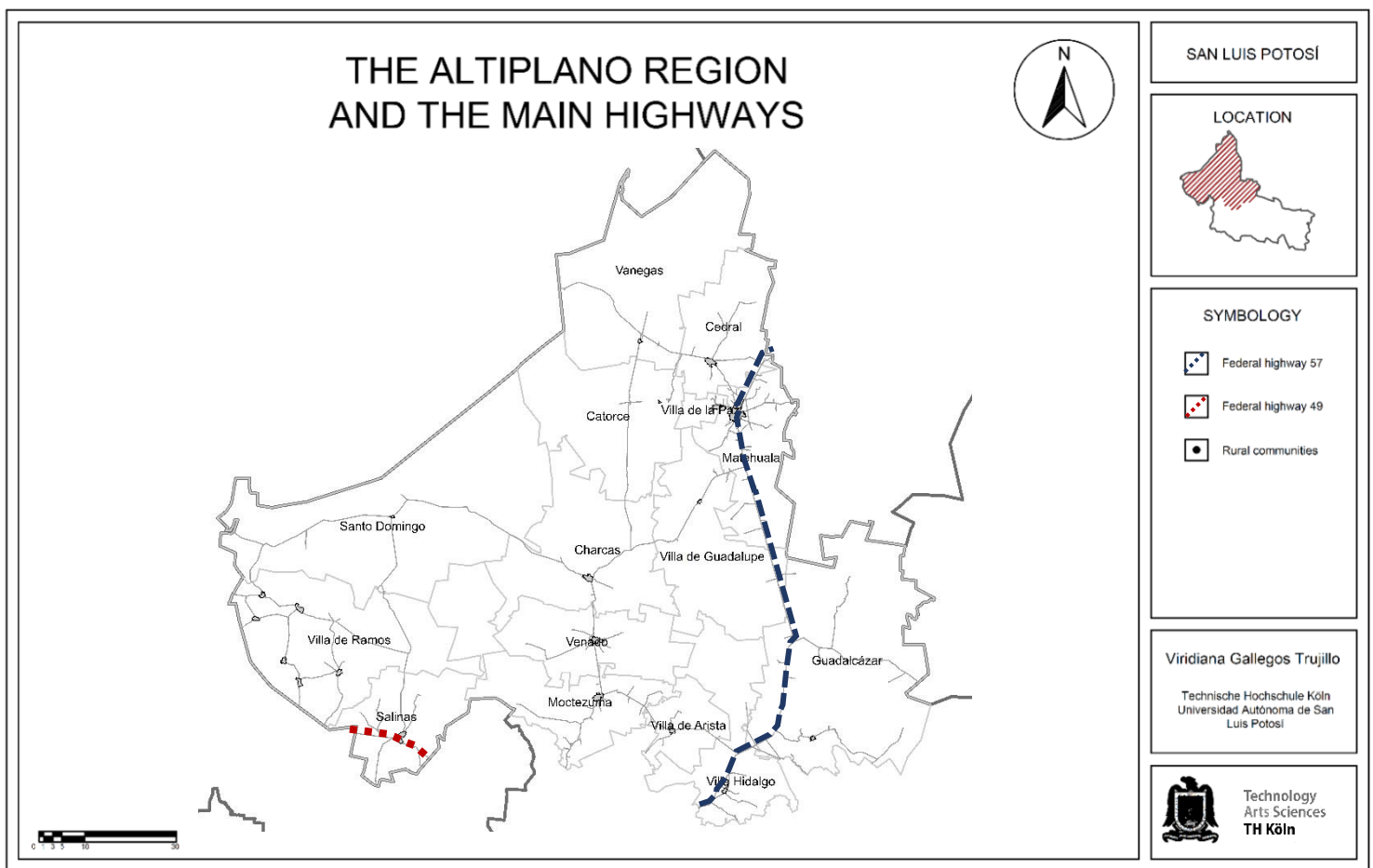


Figure 6.1 Main highways in the Altiplano region
Own elaboration based on federal data (INEGI, 2018).

These large employment locations have resulted in a population choosing to concentrate their households in the highway closest entities, developing an imbalance that local, state and municipal governments have had to face, since internal migration is evident. The internal organization to legislate and try to cover these growing and demanding popular needs for the connectivity and mobility within the Altiplano region, are presented in this section.

6.1 Political-administrative organization of the region

The globalizing scenario proposes challenges in the administrative political sphere, cultural dynamics, the functions of the State and the relationship between the society itself (Morong R. & Sánchez E., 2006). To understand the dynamics taking place within the Altiplano of San Luis Potosí, the administrative context for decisions and the implementation of strategic programs is presented next.

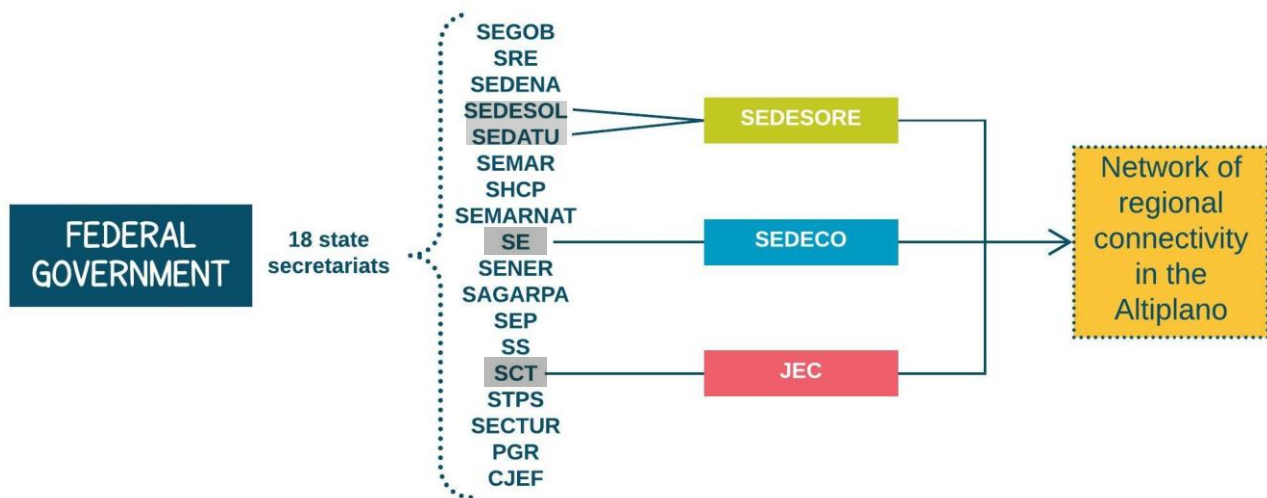


Figure 6.2 Federal and state organizations directly influencing the mobility and regional connectivity in San Luis Potosí
Own elaboration based on data from 'San Luis Potosí state government 2015 – 2021', 2018.

Mexico has 18 'State Secretariats', federal agencies in charge of coordinating projects and needs of the Mexican population. Within these 'State Secretariats', as will be seen below, are the 'Secretariat of Social Development' (SEDESOL), the 'Secretariat of Agrarian, Territorial and Urban Development' (SEDATU), the 'Secretariat of Economy' (SE) and the 'Secretariat of Communications and Transportation' (SCT), which directly influence the field of physical connectivity and mobility for the development of the entire Mexican territory.

All these federal agencies, also have support of the state organizations in order to achieve the national objectives. These 'State Secretariats' have also their own objectives, which are the result of the mediation between both local and national needs. Every six years¹⁰ the governor of the state, the leaders of the secretariats and certain directors of the state change, and with them also changes the way the management manuals and the strategies are presented and executed by the government.

The current government of the state of San Luis Potosí, as every last administration has done, has developed the "State development plan 2015 - 2021"; an operational instrument where every development plan has been prepared based on proposals, projects and actions gathered during a citizen consultation process, in order to know firsthand, the population demands. The priorities indicated, according to this document are:

¹⁰ The current San Luis Potosí government is 2015 - 2021.

	San Luis Potosí regions			
Improvement needs	Altiplano	Centro	Media	Huasteca
Fight against poverty	x	x	x	x
More and better jobs	x	x	x	x
Water and hydrological reserves	x	x	x	x
Tourism, commercial and service development		x		x
Agricultural development	x		x	
Public security	x	x	x	x
Urban infrastructure and mobility		x		
Education, culture and sport			x	x
Health and nutrition	x			x

*Table 6.1 Needs by region according to the state government
Own elaboration based on data from San Luis Potosí Government, 2015.*

As a result of this citizen survey to know the priorities of the citizenship, five main axes were created on which the current "state development plan" is centered.

SAN LUIS POTOSÍ DEVELOPMENT PLAN 2015 - 2021

	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5
Name	'Prosperous San Luis'	'Inclusive San Luis'	'Sustainable San Luis'	'Safe San Luis'	'San Luis with good government'
Main topics	More and better jobs Industrial growth Development in tourism, commerce, services and mining Infrastructure, urban development and mobility	Fighting against poverty Health and food security Education, culture and sports Equity policies	Forest resources, soil conservation and biodiversity Water and hydrological reserves Integral waste management Climate change and renewable energies	Public security Law enforcement Social reintegration Crime prevention and felony victim assistance Civil protection	Governance Prevention and combat of corruption Financial Accountability and Accountability. Open and Innovative Government Human rights
Objectives	To boost the economy of the state through investments to generate jobs from tourism and industry (mostly manufacturing). Implement more reserves to meet the new growing cities and their mobility	Promote the total coverage of health services, education, food security Increase social inclusion	To achieve a San Luis Potosí suitable for life, where the constitutional right to a healthy environment is guaranteed	To remain as one of the states with the lowest crime incidence To improve the perception of security To improve the competences of the police corps	Better economic administration by the government, Have an open, honest, effective and transparent government
Strategies	To promote schemes that facilitate the establishment of productive industrial chains and alliances and investments for tourism development	To focus the government actions to overcome basic social needs and raising income levels	To increase the state natural patrimony: its extension and its regulations The interdisciplinary management of water resources and the waste To invest in technology to decrease the climate impact	To make legislative adjustments for the convicts reintegration programs To update and strengthen the public security system	Innovation, to improve the effectiveness indicators, better order and discipline in the use of public resources, and constant evaluation of their performance.

Table 6.2 Main topics developed in the state development plan of the state
Own elaboration based on data from San Luis Potosí Government, 2015.

The state in response, is focused on developing and adhering to these main objectives during at least these six years. The state agencies, work under federal regulations in union with the local, one of the most important law for the state of San Luis Potosi, is the 'Organic Law of Administration of San Luis Potosí', in charge of regulate every task and scope each department must have.

The state laws in San Luis Potosí, are proposed and reformed by a chamber of 27 local Deputies¹¹. Currently, there are seven key laws directly influencing the administration and decision making for the regional connectivity in the Altiplano:

Name	Last modification
Traffic Law of the State of San Luis Potosi	May 3 rd 2018
Law for the Promotion of Sustainable Rural Development of the State of San Luis Potosi	April 12 th 2018
Urban Development Law of the State of San Luis Potosi	February 20 th 2018
Law for Sustainable Economic Development and Competitiveness	April 27 th 2017
Organic Law of the Public Administration of the State of San Luis Potosí	April 11 th 2017
Law of Social Development for the State and Municipalities of San Luis Potosi	September 17 th 2016
Law of Planning of the State and Municipalities of San Luis Potosi	May 7 th 2016

*Table 6.3 Laws that influence regional connectivity in the Altiplano region
Own elaboration based on (LXI Legislatura SLP, 2018)*

¹¹ The 27 deputies rule only for three years, the LXI staff of state Deputies will be replaced in 2018 through popular elections.

According to state regulations, the regional or sectoral programs will be developed only by state or municipal administrations, and all the programs must be consistent with each other and serve as a basis for the final integration of each annual budgets (San Luis Potosí State Government , 2015). This indicates that regional planning may have long-term goals, however, it is necessary to create reports to request economic support every year, in order to be included in the annual government reports.

In this way, in order to obtain the necessary financial resources for implementation, the State Secretariat of Finance is always in charge in the first instance to approve or reject every proposal, regardless of the organization that will execute it. This is also pertinent for the plans that have a regional focus; the projects proposed and/or approved by the municipal councils, must be passed directly to the state department of finance.

For the study, planning and dispatching of the businesses of the state public administration, the state government has seventeen dependencies:

1. General secretary of government
2. Secretariat of Finance
3. Secretariat of Social and Regional Development
4. Secretariat of Urban Development, Housing and Public Works
5. Secretariat of Communications and Transportation
6. Secretariat of Economic Development
7. Ministry of Agricultural Development and Hydraulic Resources
8. Secretariat of Ecology and Environmental Management
9. Secretariat of Education
10. Ministry of Labor and Social Security
11. Secretariat of Tourism
12. Secretariat of Culture
13. Administrative Office
14. General Procuracy of Justice
15. General Contralory of the State
16. Secretariat of Health
17. Secretariat of Public Safety

Within these public organizations, three stand out in the field of connectivity and regional mobility, the Secretariat of Social and Regional Development (SEDESORE), the Secretariat of Communications and Transportation (SCT) and clearly the Secretariat of Economic Development (SEDECO). Three main areas will be taken as a basis for the study of the Altiplano region: the economy, the society and its structural network.

The economic dimensions such as growth and jobs, have historically been at the forefront of describing what constitutes local and regional development. Some authors, however, have incorporated to these definitions of local and regional development, the reduction of social inequality, the promotion of environmental sustainability, an inclusive government and governance and with also the recognition of cultural diversity the population may have (Pike, Rodríguez-Pose, & Tomaney, 2006).

6.2 Regional development programs and activities

Economic development plans

To address the needs and provide solutions in the economic sphere of the state of San Luis Potosi, is the Secretariat of Economic Development; a state organization focused on promoting new investments (by national or international companies) to generate more jobs sources (SEDECO, 2018).

The last state economic report that was officially obtained from the secretariat, is with indicators of the end of 2017. According to this latest report, the Altiplano contributed 6.4% of the state's gross domestic product, as shown below.

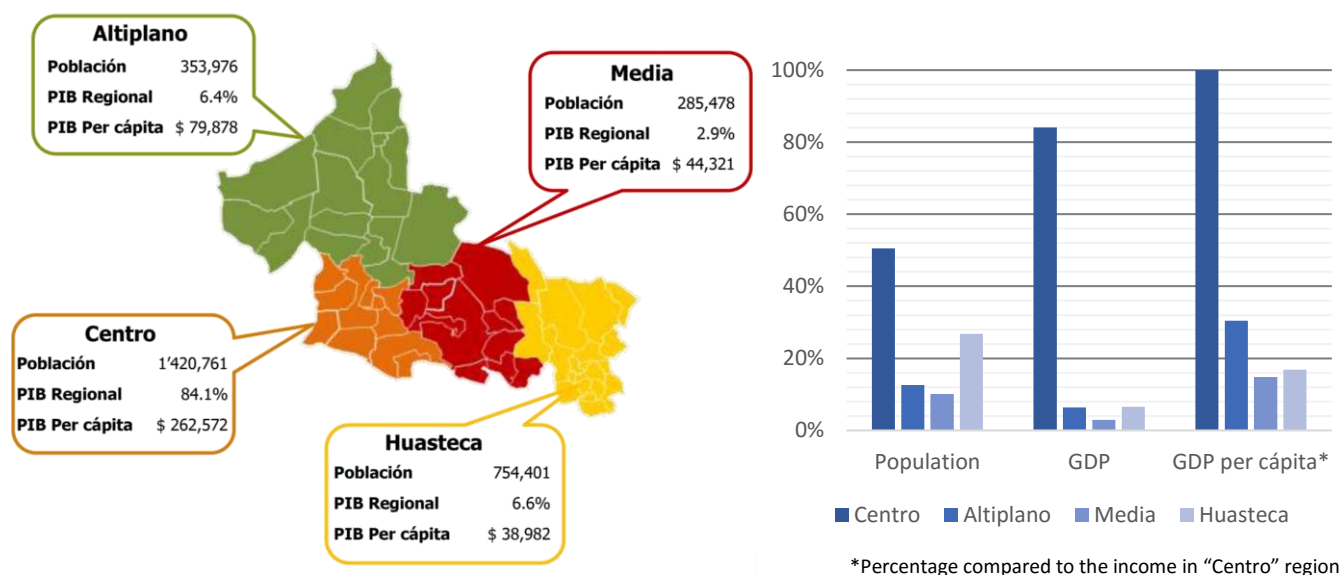


Figure 6.4 Economic data by regions within San Luis Potosí (SEDECO, 2018)

As can be seen, the gross domestic product from each region is compared, reflecting the centrality of resources in the central region; the state capital. the territory, however, covers almost half of the state, and despite the low population density, GDP per capita remains low. Within the reports made annually by this secretariat, the municipal or state figures are found, it is not common to find detailed regional reports though.

Due the importance of regional focus for state plans development and to deal with this globalized growth within the Altiplano region, the "Regional Council for the Sustainable Economic Development and Competitiveness of the Altiplano Zone" was created, which is in charge of implementing the already mentioned "Law for Sustainable Economic Development and Competitiveness" specifically for this region. This Regional Council, is focused on attracting more investing companies to be installed in this region.

As director of economic planning and competitiveness of the state, is **José Antonio Montes Ávila**, bachelor of economics and master of administration of quality systems by the “Universidad del Valle de México”. Due the importance of his decisions and the effect of this secretariat actions, an interview to this regent was pertinent. The interview included three main sets for a better organization of the topics.

In response to asking about his conception about the current state of the Altiplano, he pointed out that the region has indeed high aptitudes to develop economically. "The vocation of this area is traditionally mining and commercial, however here, 2.0% of the gross value of manufacturing production is generated," he said.

According to this secretariat figures (INEGI, 2014), the three main sources of employment in the region are trade (employs 5,474 people, 16.3% of the regional population), the manufacture of transport equipment (employs 2,516, 7.5% of the total of population) and mining (1,713 people employed, 5.1% of the regional population).

As a complement to the mentioned importance of the region for the state, he indicated that the municipalities of Salinas, Charcas and Matehuala are the ones that contribute the most to the state's GDP.

Within state graphs obtained through the state government, it is pointed out that on the second year of this government (2016), investments for mining in the region increased, so the Altiplano was the second region that received the most investments; of 100 per cent of investments, results for each region are indicated:

Altiplano	6.67%
Center	93.28%
Middle	0.02%
Huasteca	0.03%

Table 6.4 SEDECO concerted investment, by region (Montes, 2018).

Likewise, when questioned about the decrease in the employment rate presented within the region, he agreed that the figures by INEGI show those results, however, he expressed that the IMSS (Mexican Institute of Social Security) results presented by the IMSS, indicate "a gradual recovery of jobs".

Región	Sep'15	Abr'17	Mar'18	Abr'18	Variación %					
					Abr'18/Mar'18		Abr'18/Abr'17		Abr'18/Sep'15	
					Absoluta	%	Absoluta	%	Absoluta	%
Total	376,083	414,352	435,445	437,193	1,748	0.4	22,841	5.5	61,110	16.2
Centro	299,298	328,913	344,806	347,540	2,734	0.8	18,627	5.7	48,242	16.1
Huasteca	43,857	50,865	54,399	52,585	-1,814	-3.3	1,720	3.4	8,728	19.9
Altiplano	22,290	22,777	24,083	24,641	558	2.3	1,864	8.2	2,351	10.5
Media	10,638	11,797	12,157	12,427	270	2.2	630	5.3	1,789	16.8

Table 6.5 Workers insured in the IMSS by region (Montes, 2018)

Likewise, when asked about the necessary measures for the development of the Altiplano, he explained that the "Matehuala - Cedral - Villa de la Paz" route, will be an industrial corridor due to its strategic location, which will represent economic development for the region.

For future projections, the director pointed out that the GDP of the region and also per capita has increased, so a future in which more jobs are generated and economic development increases, is viable.

Social and regional development plans

To meet the needs in the social field of the state and coordinate their programs, is the already mentioned SEDESORE (Secretariat of Social and Regional Development).

This secretariat, has as general objective "to work for the social welfare and the equality of opportunities for all potosinos" (potosino refers to the gentile of the people from the state of San Luis Potosí) (SEDESORE, 2018).

The Director of State Government Planning, the engineer **Brenda Meléndez Vega** gave an interview for this investigation, for an opinion with focus on social development.

As with the previous interview, the questions were divided into three sections: the present, the necessary measures for its further development and the projections that comprise this region.

The Altiplano region, has several economic supports from the federal government; the "Strengthening Fund" and the "Municipal Social Infrastructure Fund" are distributed depending on the number of inhabitants residing in each municipality, according to the latest census and are granted if the municipalities have high or very high levels of social gap. These funds are intended to promote development and equality among the population (Meléndez, 2018).

The interviewee, pointed out that several Altiplano municipalities, such as Villa de la Paz and Charcas, receive the "Mining Fund", which encourages the sustainability of mineral extraction and invests in better technologies and training, which directly seeks a "sustainable social development".

During the interview it was indicated that with these funds, the use of 15% of the total amount can be invested on physical connectivity. The problem lies in

the fact that road infrastructure does not directly affect the social gap level, so for the federal government it is not considered a priority. In this secretariat, we understand the advantages for the population induced by the accessibility to these communities, however she expressed that their main job is to improve the indicators that directly affect our guidelines, such as drainage, public lighting and electricity.

For SEDESORE, however, there is an indicator called social cohesion, developed by a national council, the National Council for the Evaluation of Social Development Policy (CONEVAL). This council made a first effort to include social cohesion among indicators for development, this indicator includes the strategic planning of the roads, however, this program is still being completed and has not yet been implemented for the state.

For the interview, the director also noted that the secretariat (SEDESORE) itself has witnessed how accessibility directly influences development; “as an example, the health secretariat has brigades with wide coverage and very efficient, but it is different those campaigns than, in some emergency, easily be able to access the appropriate facilities to be treated” (Meléndez, 2018).

As to the necessary measures for the development of the region, it was indicated that it is necessary for the representatives of the municipalities to have initiatives and to work in conjunction with SEDESORE, have feasible projects to be able to grant greater economic support, as well as to include social cohesion in the indicators of social development.

In the field of future projections of investment and development, the map of total investments made by this secretariat in 2017 was shown, so the investment trend is clear and the projects encourage investment where there are higher concentrations of vulnerable population.

Likewise, it was told that the Secretariat will continue to make investments for infrastructure and also that an effective way to support the growth of these communication roads, as has already been done in some cases, is to provide the inhabitants with materials and train them, so they can build the roads themselves. "This is an effective way to expand the network because it cuts spending and the sense of care and belonging to the place grows" (Meléndez, 2018).

Infrastructure development plans

One of the state secretariats in Mexico is the Secretariat of Communications and Transportation (SCT), which is responsible for planning and coordinating all the infrastructure and of course transportation and communications projects. San Luis Potosí, has a state board that supports local infrastructure (JEC), however, the SCT is responsible for state plans and, therefore, the regional infrastructure that gives accessibility between municipalities.

Within this secretariat, in the department of San Luis Potosí, in the infrastructure under secretariat, is a biologist in charge of the projects sustainability. This coordinator is the engineer **Fernando Espinoza**, who was interviewed, talking about the conception of sustainability the SCT has for the state.

During the first phase of the interview, the biologist was asked about the importance attributed to the state by the Altiplano region. The area is not properly recognized for its environmental richness, the problem is the usual comparison with the most obvious values such as the ones from the Huasteca (waterfalls, cenotes, etc.), however, this region is very rich in terms of biodiversity, and the adaptability the communities, flora and fauna of the Altiplano are forced to overcome, is difficult to match, he said.

"Its importance lies precisely in the difference it presents to other regions of the state, it is important to understand that within this state very different scenarios are managed, despite not having access to the sea, in this state we have everything and they complement each other, therefore, it is impossible to compare" (Espinoza, 2018).

Likewise, he said that in terms of planning, unfortunately, there is no integral planning for road infrastructure, usually the projects are divided by municipalities or states. The projects that have been carried out during this

year, have been first evaluated through a preliminary study on the route; the current method is to obtain the coordinates, walk the area and observe species or signs of species living around the area, and in this way, to reduce the impact generated by new access roads.

As for the required measures for a better development for the Altiplano region, the biologist indicated that the cultural and ecological value of the region must be promoted. "One of the solutions could be ecological tourism", he added, "places like the waterfalls in San Bartolo, grottos of Guadalcázar, the lakes in Venado, the area where fossils are found in Charcas; if the people knew and we gave support to the local communities, the economic benefit would be superior. Support in the infrastructure tourists need such as lodging, food and transportation. Accessibility to these places is fundamental".

Finally, he indicated that for the near future, the development of the areas surrounding Highway 49 and 51 is evident; "those areas will continue to grow and attract investments," he responded.

6.3 Consistency and contradictions in the development plans for the Altiplano

As first obstacle to the Altiplano regional development, is to find out that the "sustainability" concept by each secretariat, include very different goals, and that almost each of them, comprehend opposite objectives; while the economic branch conceives this as an economical reinforcement for population, the social sphere seeks equity among the communities, just as the SCT pursues the human - environmental balance. This is a very outstanding topic to overcome the difficulties within the region; in order to achieve each objective, the support of other secretariats is indispensable and when this communication does not exist, the results are only provisional.

Within each secretariat strategy, it is evident the lack of communication between them in order to influence the mindsets to have a more specific common agreement; until now, the projects tend to be handled separately and privately from one organization to another.

As a common denominator, it was also found that the so-called "regional" plans are usually a set of plans that seek to benefit only some municipalities (within the Altiplano) and implement strategies for them, without looking at the impact of these decisions on other communities.

Likewise, the secretariats present concordances taking as an objective the development of the main cities: Matehuala, Charcas and Salinas, in its population growth and, consequently, the demand of this new population will also raise.

In the next table, an extract is shown with the standards for sustainable regional development, according to these three secretariats.

As can be appreciated, each on these secretariats have different perceptions of the reality in the Altiplano, despite having the same instruments and laws to generate strategies.

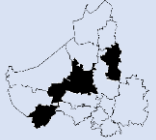

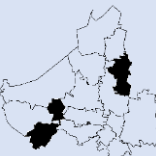
Secretariat	General objectives	Priorities	Municipalities receiving more efforts	Meaning of sustainability	Regional projects	Identified deficiencies	Regional strengths	Future projections
SEDECO	To expand the number of jobs to increase GDP among the population	To attract industrial investments		More future investments increasing manufacturing jobs	None	None	Mining, commerce and manufacturing	Growth of Matehuala industrial zone, more GDP
SEDESORE	To decrease the social gap between the state communities	To improve housing quality, access to education and health and services		Equal conditions for the population	None	Lack of accessibility indicators for social gap	Mining and commerce	The social development of Matehuala, Catorce, Charcas and Venado
SCT	To promote quality, agile and efficient public services for the inhabitants of the State	Expand and improve the quality of the road network		Growth of the road network without altering the environment	None	Lack of accessibility to some remote communities with potential to attract tourists	Mining and tourism	Growth in Matehuala and Salinas

Table 6.6 Differences and similarities between state secretariats (Gallegos, 2018)

7 INTERPRETATION AND ASSESSMENT: THE ROLE OF CONNECTIVITY IN SUSTAINABLE REGIONAL DEVELOPMENT

As the science of networks indicates, systems are more than just the set of their units; its complexity increases because it also involves their behaviors as part of the system and interactions, which can be disconcerting (Watts, 2006).

Within the region, the strong affinity from the state government to concentrate efforts in certain municipalities is evident. Despite having as a common objective, the welfare and development of the population, each secretariat has its own way of processing information and guidelines generated by the state legislative power.

These disparities in the way of thinking on the part of each organism, have generated incomplete results that generate short-term benefits, leaving the secretariat that implemented this strategy hands tied to complete and deepen their help and make these projects truly sustainable for the region.

In addition to the different methods and priorities from the state government, it is necessary to implement, especially in this complex state with so many diverse cultures and ecosystems, a regional perspective, since what has been conceived up to now as "regional plans", they are just the gathering of every result and project of the included municipalities, without being properly processed, agreed or articulated among all the involved sides for results that does not create disadvantages to any community.

The disparity between all the communities within the Altiplano, requires integral programs derived from a sustainable regional approach, where the interests and needs of each secretariat and each population are defined; this

way, it will be possible to avoid the individual interests of each agency and community.

The resources the Altiplano region has, are being only used by a few municipalities, when standardizations and comparisons emerge, competition among communities is generated to obtain external attention and investments by all means; because population growth concentration is conceived as the only way to develop, creating uncontrollable expansive urbanizations that grow in such an accelerated way, that it is not possible to properly manage the internal structure, food flows, education and health facilities, among other population needs.

The regional development must keep these precepts of hyper concentration away from their objectives, because this contrasts with the long - term vision, and just as the "tragedy of the commons" dilemma, the resources of this territory are subject to competitions between municipalities and scarcity is not beneficial for any community.

There is a risk in attracting investment and justifying it as means of regenerating local and regional economies and generating employment even at the risk of bankrupting their treasuries. As a result, such competition is undermining the potential long-term benefits. Their main development strategy, they are a pure waste since they do not lead to a significant increase in welfare at the local, or the national level (Pike, Rdz. Pose, & Tomaney, 2006).

8 CONCLUSION

8.1 Review of objectives

The state of San Luis Potosí has proved to be a wide diverse state; it is possible to observe big differences in the way each region develops; therefore, this investigation aims to be an instrument to understand in a more concrete way, the particularities of the Altiplano region, which throughout this work, proved to have a different kind of complexity from other regions in San Luis Potosí.

For the development of this work, it has been vitally important to observe the benefits that come with addressing the aptitudes and needs of the communities on a regional scale, because as noted, some problems are bigger than the localities themselves, and also, it is impossible to solve them with strategies with a general scope such as the ones promoted for the entire state.

Likewise, the support the Altiplano population requires for the internal balance and, this way, to impulse the sustainable regional development, are not completely assimilated by the state authorities, which don't have a good articulation between them and, although together are seeking only the population welfare, they are not yet able to lay on accurate tools to fully know the impact every decision produce.

It is true that each secretariat performs well in achieving its own objectives, however, within this investigation it was possible to verify that the decisions taken by each organization, indirectly influence the results of the others, and also that each secretariat, has very different purposes for the region.

Within the state, a municipal focus prevails, which generates fragmentation among the communities due to competition for resources and opportunities to which they are coerced, without having the opportunity to find among them a complement for the common benefit.

These praxes have generated that the interests of the municipalities with greater economy and population, naturally win these competitions, in order to direct the state strategies which, represent more benefits for them. In this way, the concentration of resources has been accelerated in municipalities such as Matehuala, Charcas and Salinas, forcing the population of other localities to enhance these territories to improve their lifestyle and, thus, the imbalance within the region, increases.

These imbalances are deeply reflected in the physical structure for connectivity and in the facilities to provide the most basic needs that by constitutional right every Mexican must have access to. As mentioned in chapter five, it is evident the concentration pattern and the lack of regional instruments for the strategic planning of physical elements and internal connectivity within the region.

The very elements that make the Altiplano such a particular region within the state are seen by state secretariats as weaknesses, such as the low annual precipitation (average rainfall of 460mm per year), the tendency of the population to settle in a dispersed manner and the climatic adversities, however, with a regional approach, these same obstacles determine that the particular Altiplano productivity, with a strategic connectivity, complement the rest of the state, because these types of productions are not carried out in any other municipalities.

8.2 Recommendations

The first obstacle found to deepen the analysis within this investigation, was the lack of information or the inconsistency of some of this information, because due to the different data bases that have been generated during the last years, it has not been possible to make a proper comparison between the connectivity network through the years.

Likewise, due to the available regional information, in the educational field, the results have been skewed in some municipalities, as well as in those related to health, since the type of health facility is not indicated in greater detail nor the quality of those found in each location.

The free access and distribution of data in dependencies such as the Government Education Secretariat of the State of San Luis Potosí, has different data from those shown by INEGI, however, they are not represented cartographically, so the complementation of data for investigations such as this presented for regional development, is crucial.

The sharing of data and strategies by the secretariats through state organizations created specifically for these articulations, would also represent an advance towards successful planning to benefit this region.

It is also necessary to create regional organizations capable of managing the specific needs of each region, with the aim of solving problems in a sustainable way, since the demands of the state capital generate burdens to other sectors that do not have the infrastructure or the skills to satisfy them in a sustainable manner.

8.3 Further research demands

As a continuation of this research, it is possible to create a local accessibility study for each community within the Altiplano, since quality services for this population are, as previously shown, inaccessible for a large number of localities, as well as separating basic needs that each community manifests.

During this investigation, it was difficult to obtain reliable statements due to the inconsistency of some statistics; it is necessary to deepen information on education, health and infrastructure, so that these statistics represent a more determinant tool to make decisions by the authorities.

The type of routes that students must daily travel in order to access the school facilities, as well as the relationship between this connectivity and the percentage of abdication by the population, are data that would also complement this type of regional studies.

Mayo, 2018

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DESARROLLO ECONÓMICO EN EL ALTIPLANO POTOSINO Y SU CONECTIVIDAD FÍSICA

1. PERCEPCIÓN DEL ALTIPLANO

¿El Altiplano, como región, cuenta con aptitudes para apoyar de manera importante (actualmente o en el futuro) el desarrollo económico del estado?

¿Cuál considera que es la vocación económica del Altiplano?

¿Cuáles cree usted que son los municipios clave (Altiplano) para impulsar el desarrollo regional?, ¿Por qué?

¿Considera que hay más esfuerzos e inversiones hacia otras zonas (Media, Huasteca o Centro) que hacia la zona Altiplano? ¿Por qué?

Según estadísticas (SEDECO, 2015), todos los municipios del Altiplano han presentado una considerable disminución del porcentaje de la población económicamente activa (2010 – 2015), ¿cuál cree que sea el motivo? ¿Y considera usted que ese es el motivo por el cual la población en el 40% de sus municipios de la región ha disminuido?

2. MEDIDAS NECESARIAS PARA SU DESARROLLO

Dentro del “Plan estatal de desarrollo”, la planeación para el desarrollo del Altiplano se centra en el “Corredor Industrial Matehuala – Cedral – Villa de la Paz”, ¿existen otros proyectos dentro de esta región para su impulso económico y laboral?, si es así ¿podría mencionar los más relevantes?, si no, ¿Cuál es la razón para concentrar los esfuerzos en este proyecto?

¿Cuáles cree que son las medidas necesarias para la estabilidad económica de la región y que cree que ha faltado para incrementar su desarrollo?

¿Considera usted que la planeación para la conectividad física (carretera) entre entidades es de importancia para el desarrollo económico del Altiplano? ¿De qué manera?

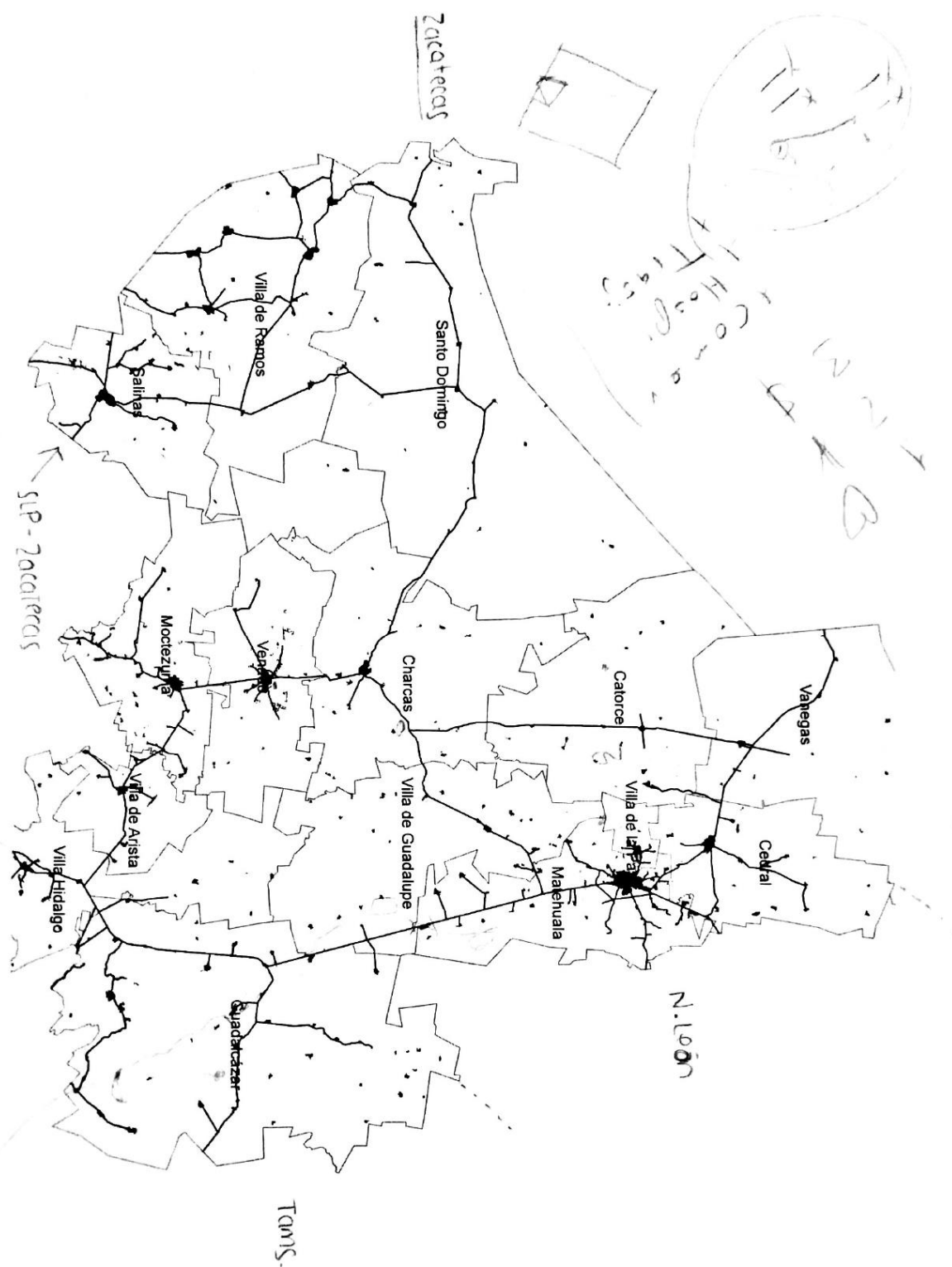
3. PROYECCIONES PARA LA REGIÓN

¿Cómo considera usted que se encontrará en materia de desarrollo económico e inversiones para la conectividad física el Altiplano para el 2021?

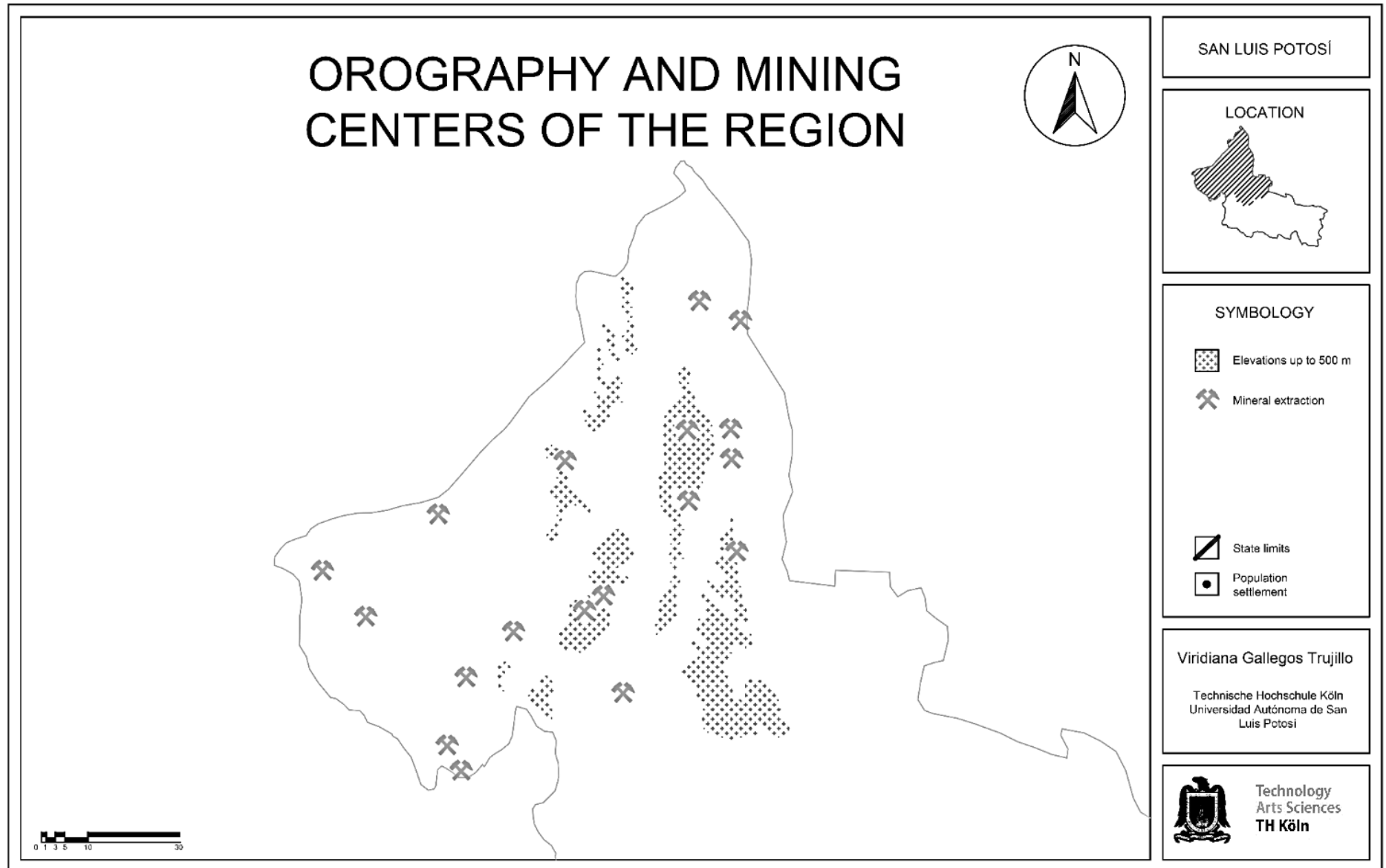
¡Muchas gracias por su paciencia y atención!

Viridiana Gallegos Trujillo

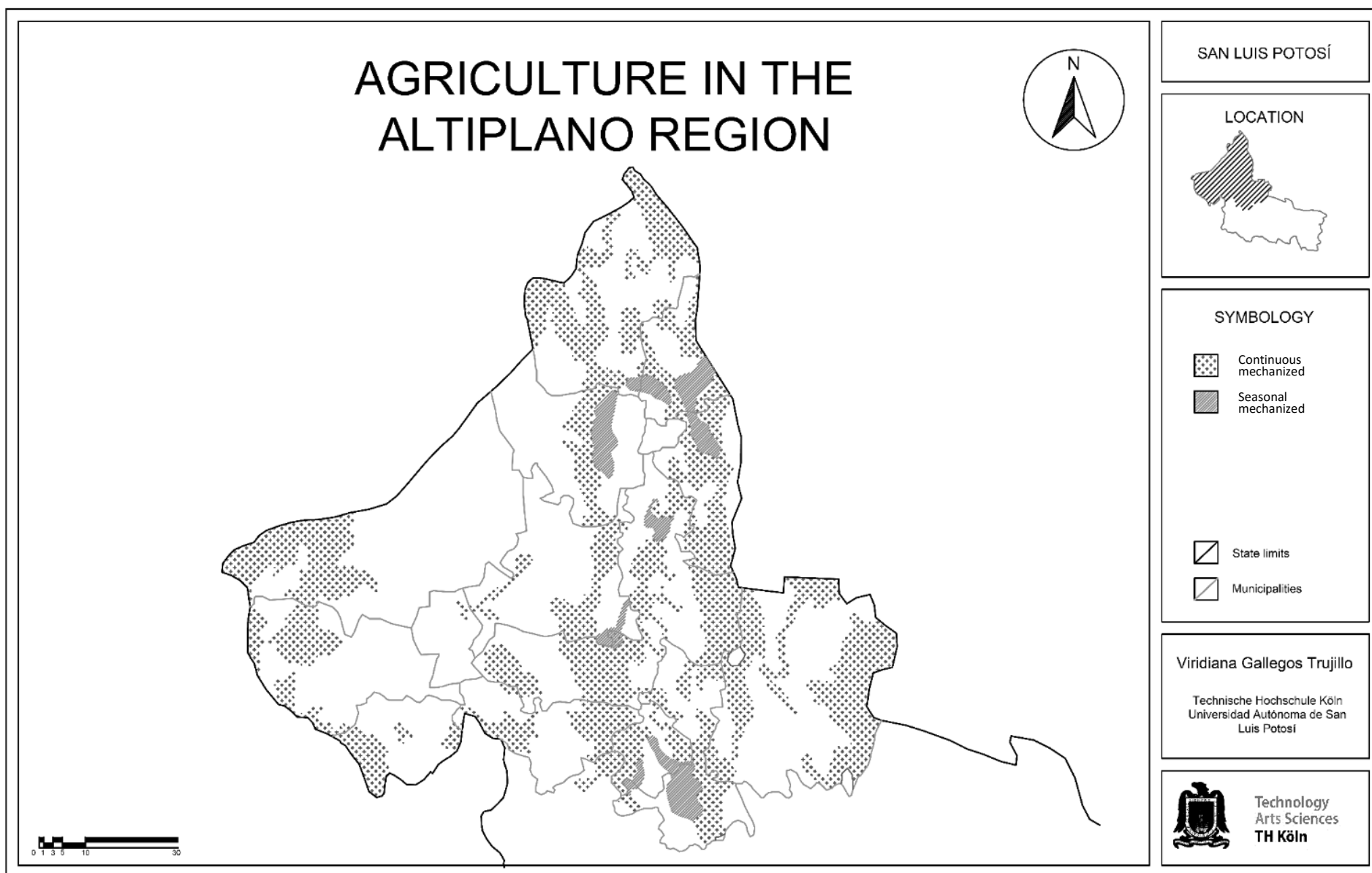
Estudiante de Maestría de Doble Titulación por parte de la UASLP (SLP, México) y la TH Köln (Colonia, Alemania).



Appendix B Example of a map provided to the interviewees for graphic descriptions.



Appendix C Mining location and orography within the region
Own elaboration based on federal data (INEGI & SLP GOB, 2016).



Appendix D Type of agriculture inside the Altiplano region
Own elaboration based on federal data (INEGI & SLP GOB, 2016).

10 REFERENCES

- Acevedo, J., & Bocarejo, J. (2009). Movilidad sostenible: una construcción multidisciplinaria. *Ingeniería, Bogotá*, 72-74.
- Albarrán, A. S. (2016). Sociología rural y nueva ruralidad sur-sur. *Cuaderno Venezolano de Sociología*, 49-63.
- Álvarez, U. C. (2009). Estructuras regionales emergentes y desarrollo turístico sustentable: la región costa sur de Nayarit, México. Puerto Vallarta, Jalisco: Universidad de Guadalajara. Centro Universitario de la Costa.
- Asuad, N. (2014). *Teorías de la distribución espacial de las actividades económicas*. Mexico City: UNAM.
- Bataillon, C. (1993). *Las regiones geográficas en México*. Cd. México: Siglo veintino editores.
- Caillods, F. (1983). *School mapping and micro-planning in education*. UNESCO.
- Cambridge dictionary. (2018, May). *Connectivity definition*. Retrieved from <https://dictionary.cambridge.org/es/diccionario/ingles/connectivity>
- Cambridge Dictionary. (2018, May). *Meaning of “sustainability” in the English Dictionary*. Retrieved from <https://dictionary.cambridge.org/dictionary/english/sustainability>
- Casado, J. (2008). Estudios sobre movilidad cotidiana en México. *Revista electrónica de geografía y ciencias sociales*.
- Celis, F. (1988). El espacio, la región y la regionalización.

- Chillón, P., Panter, J., Corder, J., Jones, A., & Van Sluijs, E. (2015). A longitudinal study of the distance that young people walk to school. *Health Place*, 133-137.
- Christaller, W. (1933). *Die zentrale Orte in Suddeutschland*. Darmstadt.
- Corey, K. E., & Wilson, M. I. (2006). *Urban and regional technology planning*. New York, USA: Routledge Taylor & Francis group.
- De Carvalho, J., & Fogliatti, M. (2016). Methodology for leading indicators on sustainable regional development. *Revista de Administração Pública - RAP*, 395-423.
- Di Virgilio, M. (2011). La movilidad residencial: una preocupación sociológica. *Territorios*, 173-190.
- Dick, E., Inkoom, D., Teodoro, K., & Gaesing, K. (2016). Decentralisation and regional development. *Springer Geography*.
- EDC. (2013). Access to Education in Rural Areas of Mali. *Educational Development Center*. Retrieved from Educational Development Center: http://idd.edc.org/sites/idd.edc.org/files/Mali%20Rural%20Ed%20EDC_0.pdf
- Elahi, A., & Elahi, M. (2006). *Data, network and internet communications technology*. New York, USA: Thomson Delmar learning.
- ESANUT. (2013). *Informes 2012*. Mexico City: ESANUT.
- Espinoza, F. (2018). The structural network of the Altiplano. (V. Gallegos, Interviewer)
- FAO. (2006). *Food Security - Policy Brief*. Rome, Italy: FAO.

- Figueroa, O., & Rozas, P. (2005). Conectividad, ámbitos de impacto y desarrollo territorial. *CEPAL*.
- García-Bellido, J. (2000). Ildefonso Cerdá y el nacimiento de la urbanística. *Scripta Nova, Universidad de Barcelona*.
- Gutiérrez Chaparro, J. (2009). Planeación urbana en México: un análisis crítico sobre su proceso. *Redalyc, Red de Revistas Científicas de América Latina, el Caribe, España y Portugal*, 52-63.
- Hatzichronoglou, T. (1996). *Globalisation and competitiveness : relevant indicators*. Paris, Francia: OECD.
- Herranz, J. (2015). Academic training in the certification of medical facilities in Mexico. *Horizonte Sanitario*, 37 - 41.
- Hottes, R. (1997). Werk und Leben Walter Christallers. *Angewandte Geographie*.
- INEGI. (1985). *Geographic synthesis of the state of San Luis Potosí*. Mexico City: INEGI.
- INEGI. (2011). *Población rural y urbana*. Retrieved from http://cuentame.inegi.org.mx/poblacion/rur_urb.aspx?tema=P
- INEGI. (2018, July). *Acerca de INEGI, quiénes somos*. Retrieved from http://www.beta.inegi.org.mx/inegi/quienes_somos.html
- INEGI. (2018). *Mexico en cifras*. Retrieved from <http://www.beta.inegi.org.mx/app/areasgeograficas/#>
- INEGI, & SLP GOB. (2016). *Anuario estadístico y geográfico de San Luis Potosí*. Mexico City: INEGI.

- Iracheta, A. (2001). *Planeación Regional en México*. México D.F.
- ITER INEGI. (2016). *Principales resultados por localidad*. Ciudad de México.
- Jiménez-Jiménez, J., de Hoyos-Martínez, J., & Álvarez-Vallejo, A. (2014). Transporte urbano y movilidad, hacia una dinámica urbana sustentable y competitiva. *Quivera*, 39-53.
- Johnston, P., Everard, M., Santillo, D., & Robert, K.-H. (2007). Reclaiming the Definition of Sustainability. *Env Sci Pollut Res*, 60-66.
- Khalifa, M., & Salheen, M. (2014). Understanding urban segregation in Cairo: The social and spatial logic of a fragmented city. Abu Dhabi, United Arab Emirates: Smart, sustainable and healthy cities.
- Kindsein. (2013). *IWALK: Caminar a la escuela*. Retrieved from <http://www.kindsein.com/es/24/2/566/>
- Klapka, P., Halás, M., & Tonev, P. (2013). Functional Regions: Concept and Types. *International colloquium on regional sciences*, 94-101.
- Korstanje, M. (2013). Homo Mobilis, la nueva era de la movilidad. *Alteridades, Universidad Autónoma Metropolitana Unidad Iztapalapa*.
- László, J. (2014). *Historical Tales and National Identity. An Introduction to Narrative Social Psychology*. London: Routledge.
- Lösch, A. (1978). The economics of location. In *Translation by William H. Woglom*. Westford, Massachusetts: Yale University Press.
- LXI Legislatura SLP. (2018, June). *H. Congreso del Estado de San Luis Potosí, Legislaciones*. Retrieved from <http://congresosanluis.gob.mx/legislacion/leyes>

- Malaver, M., Rivera, H., & Alvarez, L. (2010). La ciencia de las redes, la conectividad y la sociedad. *Barcelona*, Paidós.
- Martner, C., Balbuena, A., Bustos, A., & De La Torre, E. (2008). *Transporte y territorio, movilidad regional en San Juan del Río*. Santiago de Querétaro, Qro.: Instituto mexicano del transporte.
- Meléndez, B. (2018). Social development for the Altiplano. (V. Gallegos, Interviewer)
- Mendel University in Brno. (2010). *Classification of regions*. Retrieved from Faculty of Regional Development and International Studies: https://is.mendelu.cz/eknihovna/opory/zobraz_cast.pl?cast=62192
- Mexican Republic Government. (2018). *Obras para ti, región Centro - Norte*. Retrieved from <https://www.gob.mx/sct/articulos/obrasparati-region-centro-norte>
- Mexican Republic Government. (2013). *Reforma Educativa*. Retrieved from https://www.gob.mx/cms/uploads/attachment/file/2924/Resumen_Ejecutivo_de_la_Reforma_Educativa.pdf
- Meyenberg, Y. (2012). Los intereses públicos y la gobernanza. *Revista del Colegio de San Luis*, 68-87.
- Molinatti, F., Rojas-Cabrera, E., & Peláez, E. (2014). Movilidad residencial intraurbana en contextos de escasos recursos. Córdoba (Argentina). *Revista Bitácora Urbano Territorial*, 31-39.
- Moncayo, E. (2001). Modelos de desarrollo regional: teorías y factores determinantes.
- Montes, J. (2018). The Altiplano economic perception. (V. Gallegos, Interviewer)

- Montoya, R. (2013). *Guía de investigación del pasado colonial potosino*. San Luis Potosí: UASLP.
- Morong R., G., & Sánchez E., E. (2006). Thinking north: The historiographic construction of the frontier space in the context of the 1883 - 1929 chilenization. *Universidad de Tarapacá, ciencias históricas y geográficas*, 95-112.
- OECD. (1992). *Structural competitiveness: definition*. Organización para la Cooperación y el Desarrollo Económico.
- OECD. (2016). *Health Care Resources*. Paris, France: Organisation for Economic Co-operation and Development .
- OECD. (2017, June). *Organization for Economic Co-operation and Development*. Retrieved from Regional Development: <http://www.oecd.org/regional/regional-policy/regionaldevelopment.htm>
- OECD. (2018). *Health at a Glance, OECD indicators*. Paris, France: Organisation for Economic Co-operation and Development.
- Palacios, J. (1983). El concepto de región. *Revista Interamericana de Planificación*, 56-68.
- Pike, A., Rodríguez-Pose, A., & Tomaney, j. (2006). *Local and Regional Development*. New York City, USA: Routledge.
- Podestá A., J. (2011). Regiones fronterizas y flujos culturales: La peruanidad en una región chilena. *Universum*, 123-137.
- Powell, P. (1945). *The Chichimecas: Scourge of the Silver Frontier in Sixteenth-century Mexico*. *Hispanic American Historical Review*.

- Powell, P. (1996). *La guerra Chichimeca*. Mexico City: FCE.
- Rodríguez-Oreggia, E. (2007). Winners and losers of regional growth in Mexico and their dynamics. *Investigación económica*, 43-62.
- Rosales, M. (2009). Definición e importancia del desarrollo regional., (p. 15). Valparaíso, Chile.
- Rozas, P., & Figueroa, O. (2005). *Conectividad, ámbitos de impacto y desarrollo territorial*. Santiago de Chile: CEPAL.
- S. L., & D. J. (2008). Cities with attributes: connectivity, accessibility and mobility. *Ciudades: Instituto Universitario de Urbanística de la Universidad de Valladolid*, 13-32. Retrieved from <http://www3.uva.es/iuu/REVISTA/Ciudades%2011/Ciudades%2011%20013-032%20SANTOS%20y%20DE%20LAS%20RIVAS.pdf>
- Safe Routes. (2018). *National Center for Safe Routes to School* . Retrieved from <http://www.saferoutesinfo.org>
- Salguero, J. (2006). Enfoques sobre algunas teorías referentes al desarrollo regional. Bogotá, Colombia.
- San Luis Potosí State Government . (2015). *State Development Plan 2015 - 2021*. San Luis Potosí, Mexico: COPLADE.
- Sassen, S. (1999). *The global city*. Buenos Aires, Argentina.
- SCT. (2012). *Reglamento de Tránsito en Carreteras y Puentes de Jurisdicción*. Mexico City.
- SECTUR. (2015). *Secretaría de Turismo del Estado de San Luis Potosí, Informe anual*. San Luis Potosí: Gobierno del Estado.

SEDECO. (2009). *Regiones de San Luis Potosí, Generalidades*. San Luis Potosí: Gobierno del Estado de San Luis Potosí.

SEDECO. (2016). *Secretariat of Economic Development of the State, Economic Panorama of San Luis Potosí*. San Luis Potosí.

SEDECO. (2017). *Indicadores básicos por municipio*. San Luis Potosí: Gobierno de San Luis Potosí.

SEDECO. (2017). *Panorama Económico del Estado de San Luis Potosí*. San Luis Potosí: State Government of San Luis Potosí.

SEDECO. (2017). *THE REPORT, San Luis Potosí 2017*. San Luis Potosí, SLP: Secretaría de Desarrollo Económico.

SEDECO. (2018). *Archivo Histórico Lic. Antonio Rocha*. San Luis Potosí, SLP: Gobierno del Estado de San Luis Potosí.

SEDECO. (2018). *Indicador Trimestral de la Actividad Económica Estatal*. San Luis Potosí, SLP: SEDECO.

SEDECO. (2018). *Quiénes somos*. Retrieved from <http://beta.slp.gob.mx/SEDECO/Paginas/QUIENES%20SOMOS.aspx>

SEDESOL. (2015). *Secretariat of Social Development SEDESOL*. Retrieved from <http://www.microrregiones.gob.mx/catloc/contenido.aspx?refnac=240280001>

SEDESOL. (2018). *Informa anual sobre la situación de pobreza y rezago social 2018*. Retrieved from https://www.gob.mx/cms/uploads/attachment/file/288967/San_Luis_Potos_.pdf

SEDESORE. (2014). *Diagnóstico microrregional de Altiplano 2014*. San Luis Potosí, Mexico: SEDESORE.

SEDESORE. (2016). *Diagnóstico microregional Altiplano Oeste*. San Luis Potosi: Gobierno del Estado 2015 - 2021.

SEDESORE. (2018). *Who we are*. Retrieved from <http://www.sedesore.gob.mx/sedesore/index.php>

Statista. (2018). *The 30 largest countries in the world by total area*. Retrieved from <https://www.statista.com/statistics/262955/largest-countries-in-the-world/>

The World Bank Group. (2018). *United Nations Population Division*.

Torres, F. (2006). *Pioneros del conocimiento regional en México*. Mexico, D.F.: UNAM.

UANL. (2018). *Observatorio de la sustentabilidad de Nuevo León*. Retrieved from <http://observatorio.iinso.uanl.mx/index.php/diagnostico/diagnostico-01/diagnostico-0101?start=1>

Vela & Solanes. (2016). *Atlas del México prehispánico*. Mexico City: Arqueología mexicana.

Velasco, A. E., Maldonado, P., & Torres, J. C. (2007). Desigualdad del desarrollo regional en México. *Revista latinoamericana de economía, UNAM*, 87-102.

Verdu, D. (2014). Cuentos históricos y la identidad nacional. *Revista de Estudios Sociales, Universidad de Los Andes*, 229-232.

Watts, D. (2006). *Seis grados de separación. La ciencia de las redes en la era del acceso*. Barcelona, Spain: Paidós.

Zapata R., T. (2013). *Etnicidad e identidad étnica guachichil en el Tunal 1560 – 1620*. San Luis Potosí: Colegio de San Luis, SLP.

Zelinsky, W. (1971). The hypothesis of the mobility transition. *Geographical review*, 219-249.

Zottmann, A. (1949). Dr. Habil. August Lösch. gestorben am 30. Mai 1945. *Weltwirtschaftliches Archiv*, 28-34.